ISCTE Business School
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ENHANCING STRATEGIC MANAGEMENT USING A QUANTIFIED VRIO: ADDING VALUE WITH THE MCDA APPROACH

Nathanaëlle Nicole Sophie Murcia

Dissertation submitted as partial requirement for the conferral of
Master in Management

Supervisor:
Professor Fernando Alberto Freitas Ferreira
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ACKNOWLEDGEMENTS

The completion of this dissertation represents the end of a meaningful and intense journey in my life. Studying the field of Management has provided me with tremendous amounts of knowledge and opportunities, which I will cherish in both my personal development and professional career. The finalization of this dissertation was made possible through the support of a number of people, who I would like to thank personally in the following lines.

I am extremely grateful to have been able to work closely with my supervisor, Professor Fernando Alberto Freitas Ferreira. Not only did he provide me with constructive advice on how to perfect my arguments, but he guided me with a human approach and always included encouraging words, which allowed me to stay motivated during the most challenging times of my writing process. The determination and kindness that I witnessed, as a professor and supervisor, represent an example to be followed.

I owe the deepest sentiment of gratitude to my biggest sources of inspiration: my mother, my brother, my twin sister and my future brother-in-law, for their constant reassurance and support. The presence of my family gave me the orientation and motivation I needed to excel in my work. Having been surrounded by such a loving family has truly shaped me into the person I am today.

To Ian Pocervina, my caring friend, thank you for using your linguistic expertise to increase the quality of this dissertation. Your assistance, encouragement and affection reflect the person who I know and admire. Thank you for being an important piece of the puzzle in this dissertation and in my life.

An enormous thank you goes to the decision maker of this dissertation, Joel Murcia, my father, for his participation and suggestions. His insights helped complete this dissertation and offered knowledge that will, hopefully, be embraced by further experts.

Lastly, I would like to personally thank ISCTE, my professors, the administration and my Portuguese friends that I will always cherish and appreciate for the rest of my life.

Thank you all!

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ABSTRACT

The field of strategic management has been popularized since the 1960s, as an aid for the search of success factors amongst the internal and external surroundings of an organization. Strategic management has observed and created strategies that are considered as pillars in the present way of applying contemporary management operations. Even though strategic management relies on managers' capability to comprehend the current economic trends, this area has left a variety of questions unanswered, especially regarding the analyses of the combination of quantitative and qualitative decision criteria. This dissertation aims to enhance strategic management by developing a quantified valuable, rare, inimitable and organized (VRIO) framework, with the aid of the multiple criteria decision analysis (MCDA) approach. To accomplish this objective, the VRIO framework is combined with the Choquet integral (CI) and a real-life application is carried out to support strategic management. The dual methodology used in this dissertation offers an innovative process for business improvement. The benefits and limitations are also presented and discussed.

Keywords: Strategic Management; VRIO Framework; Multiple Criteria Decision Analysis (MCDA); Choquet Integral (CI).

EXECUTIVE SUMMARY

VRIO stands for valuable, rare, inimitable and organized, representing one of the most recent tools for internal analyses of organizations. The purpose of this dissertation is to present a quantified VRIO and show the potential of its practical application in real-life business environments. The area of strategic management emerged almost 60 years ago and has since created countless strategies and techniques that have been shaped into key pillars in various industries. Many authors have expressed the following benefits: (1) the importance of applying adequate strategies to achieve rewarding performances; (2) the relevance of internal capabilities and external opportunities; (3) the significance of the fitting formulation and implementation of techniques; and (4) the weight that managers have on the achievement of successful operations. Considerable methods have been developed to tackle on internalization, rivalries, strategies, management leadership or corporate social responsibility. The traditional evaluation of research methods was, however, often done with case studies. If a firm wishes to evolve, it has to adapt to current movements and find ways to demark itself from competitors, all in a climate that faces constant changes. Even though strategic management offers endless possibilities in terms of strategies, an innovative methodology is considered necessary to obtain a quantified VRIO. Accordingly, the resource-based view (RBV) and the VRIO framework were chosen as a means to further understand the importance of tangible and intangible resources, the development and performance of an organization, as well as the weight of resources inside an organization, which can be characterized as valuable, rare, inimitable and organized, and could furthermore lead to sustained competitive advantage. Nonetheless, limitations have been observed for VRIO and RBV, in terms of analyzing quantitative criteria, addressing criteria as a singular entity, refusing the evaluation of inimitable resources and resolving the use of outdated techniques. To address these limitations, multiple criteria decision analysis (MCDA) is used, encouraging the participation of decision makers and allowing for the structuring of complex decision problems. For the mathematical calculation of the outcomes, the Choquet integral (CI) was employed.

CI is based on two fundamental conditions: (1) utility values are applied on a regular interval scale that focuses on criteria performances; and (2) a ratio scale is applied on a numerical value of μ(T) to each subset (T). It is of great importance that the scores received by the objective and subjective judgements of the decision maker are ranked from smallest to largest to be able to calculate the variation of utilities according to diverse criteria. The "why" is comprehended, as the elucidation of aggregation is of higher matter in the decision process and allows for quantitative feedback, and moreover accepts the interrelationship and interconnection between criteria. This fuzzy integral method was chosen as part of the methodology, as it highlights transparency, offers clear results and praises communication with the decision maker to obtain satisfactory results based on information sharing and subjective observations.

The decision maker was based on a single person, who introduced Coliving Factory (CF) – *i.e.*, a real estate company focusing on an inventive way of cohabiting. To further understand the principles of this company, six steps were endorsed: (1) list of the most crucial resources and capabilities; (2) creation of a categorization system (*i.e.*, human capital, finance, physical assets, and organization); (3) application of the categorization system to CF's resources and capabilities; (4) confirmation of the VRIO postulates of applicability; (5) application of the VRIO matrix; and (6) identification of critical factors of success. The scores obtained for the diverse combinations of categories allowed for the comprehension of the performance level of CF and its two main competitors (*i.e.*, The Babel Community (TBC) and La Casa (LC)). The final outcomes present a slight difference between the three companies, as CF only obtained the first place by outranking TBC by one point. As a conclusion, it can be observed that the methodology conceived for this dissertation facilitated the analysis of hybrid criteria and delivered clear and transparent results, which could be utilized to improve business operations. Furthermore, this methodology is applicable on any business and/or by any expert who faces the dilemma of exanimating quantitative and qualitative resources and capabilities. Hopefully, the following proposal will evolve into an innovative research method in the field of strategic management.

GENERAL INDEX

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FIGURES

TABLES

MAIN ABBREVIATIONS USED

AHP	− Analytic Hierarchy Process
CF	− Coliving Factory
CI	− Choquet Integral
CSR	− Corporate Social Responsibility
ELECTRE	− Elimination and Choice Expressing Reality
FIN	− Finance
HC	− Human Capital
LC	− La Casa
MACBETH	− Measuring Attractiveness by a Categorical Based Evaluation Technique
MAUT	− Multi-Attribute Utility Theory
MAVT	− Multi-Attribute Value Theory
MCDA	− Multiple Criteria Decision Analysis
MCDM	− Multiple Criteria Decision Making
NAM	− Non-Additive Measures
NRBV	− Natural-Resources-Based View
ORG	− Organizational
PHA	− Physical Assets
RBV	− Resource-Based View
SOFT OR	− Soft-Operational Research
TBC	− The Babel Community
TOPSIS	− Technique for Order Preference by Similarity to an Ideal Solution
VFT	− Value-Focused Thinking
VRIO	− Valuable – Rare – Inimitable – Organized

INTRODUCTION

A. General Background

The field of strategic management was popularized 60 years ago, aiming at the discovery of success factors that can be identified in both the internal and external environment of organizations. Deeper understanding of the current economy by managers represents a key pillar of strategic management, regarding competitors, financial demands, governments or customers. By having the ability to understand the desired demands, success factors can be met in an ever-changing world and lead to the achievement of set goals and objectives. The development of strategic management demonstrated the enormous influence that strategy exerts on performance, the opportunities that can be achieved on internal and external capabilities, the relevance of formulation and implementation of strategies as well as the value and expertise that managers can bring to an organization. Strategic management was able to mature, due to the interest that was shed on different subjects, as the broadcasting of internalization evolved different types of strategies, competition, growth of management and corporate social responsibility (CSR). The increase of research methods led to go further than case studies analysis and gained accessibility to qualitative methods and the combination of quantitative and qualitative methodologies (*i.e.*, hybrid techniques). Additionally, sustainability and environmental concern were formerly ignored, as managers considered internal capabilities as the pillars for the achievement of competitive advantage.

Newly approaches have been introduced to strategic management to meet the expectations and demands of stakeholders, and moreover avoid environmental destruction. Additionally, the influence of technology and the access to limitless information have boosted competition and demand rapid reactions to avoid the loss of leader position in any field. Therefore, strategic management should strongly consider the rise of new trends, as well as alternative approaches, to achieve diversified objectives and resist against competition. Even though strategic management allows for a variety of possibilities, the focus of the present study is on enhancing this specific field and overcoming some of its methodological limitations by using the following frameworks: (1) resource-based view (RBV); (2) valuable, rare, inimitable and organized (VRIO) framework; and (3) multiple

criteria decision analysis (MCDA), in this case supported by the aid of the Choquet integral (CI), which facilitates the measurement of combined qualitative and quantitative criteria.

B. Research Objectives

Even though strategic management offers a multitude of possibilities and strategies that can be applied to various management scenarios, the VRIO model has not yet been quantified, which provides an opportunity for innovation that could enhance the field of strategic management. Black and Boal (1994) disagree with the VRIO framework instituted by Barney (1991), due to the lack of consideration of bundles of resources, as the model considers resources as singular factors. Barney (1991) presumed that the application of four criteria (*i.e.*, valuable, rare, inimitable, organized) would allow for the identification of the most promising resources and lead to sustained competitive advantage. Nonetheless, numerous authors hold different opinions on the traditional framework and believe that a modernized approach would be to acknowledge resources in a network of interrelationships (Grant, 1991; Hoskisson *et al.*, 1999). Additionally, RBV and VRIO are complex to analyze in terms of quantitative criteria and suffer from similar challenges, as both frameworks struggle to measure intangible resources. Godfrey and Hill (1995) believe that inimitable resources are represented as intangible and thus cannot be easily measured. Other authors have faced similar challenges and have attempted to solve these issues by applying coarse-grained measures (*e.g.*, Miller and Shamsie, 1996; Hoskisson *et al.*, 1999), and large data samples (*e.g.*, Markides and Williamson, 1994; Hoskisson *et al.*, 1999). However, the difficult process of analyzing intangible resources required the application of case studies, field studies and prominent samples (*e.g.*, Hoskisson *et al.*, 1999). Additionally, the VRIO model disregards quick or uncalled modifications that can appear in chaotic environments and might lead to changes in strategy formulation.

The limitations observed over the last few decades by various authors support the creation of a different methodology, which may offer solutions regarding the intercorrelation of criteria and the measurement of intangible resources. To create such a methodology, which could improve the analysis of both quantitative and qualitative resources, different frameworks will be combined and further delineated in the empirical part of this dissertation.

Due to the multitude of limitations listed for the VRIO framework, multiple criteria decision analysis (MCDA) was adopted in this study to understand whether the merging of

the frameworks could lead to a win-win situation. MCDA exhibits a methodological approach that allows for the clarification of complex decision situations. MCDA concentrates on the full participation of decision makers, boost constructivism and encourages the solidarity of subjectivity and objectivity in the decision-making process. Furthermore, MCDA is suited to solve complex decision problems characterized by high unpredictability, conflicting objectives and various types of data. MCDA also represents an appropriate approach for the analysis of quantitative and qualitative resources and capabilities. Further on, the Choquet integral (CI) is presented to get a deeper understanding about the interaction amongst criteria. CI insists on the cruciality of a specific criterion, while understanding the interactions with different criteria. The two fundamental conditions of CI are that: (1) utility values are on a common scale; and (2) a ratio scale is used for numerical value $\mu(T)$ according to each subset (T). The results obtained by the decision maker will be ranked on a common scale from smallest to largest, so as to calculate the dissimilarities of utilities. Additionally, CI offers supplementary insights, clearer results and transparency. Moreover, the advantage of applying CI lies in understanding the "why" and "how" in the elucidation, to make wiser decisions and provide insight on the merging of qualitative and quantitative questions. This dissertation aims at demonstrating a brand-new approach of applying CI combined with the VRIO framework, so as to obtain a quantified VRIO.

C. Methodology

As previously mentioned, the methodology of this dissertation is designed to enhance the field of strategic management by demonstrating an innovative quantified VRIO. Correspondingly, the methodology is based on the following theoretical frameworks: (1) RBV; (2) VRIO; (3) MCDA; and (4) CI. RBV offers a framework that concentrates on the adequate use, bundle and exploitation of internal resources to obtain sustainable competitive advantage (Barney, 1991). Furthermore, two crucial categories are defined: tangible and intangible resources. These categories can be further divided into four categories that are of extreme importance to this dissertation; (1) human capital; (2) finance; (3) physical assets; and (4) organization. VRIO is useful for the evaluation of resources and capabilities and to further comprehend if sustainable competitive advantage can be achieved. Consequently, if capabilities and resources meet the four pillars of VRIO (*i.e.*, valuable, rare, inimitable, organized), sustained competitive advantage is attained. Critical factors of success (CFS)

can also be implemented to explain how specific competitors, complex strategies applied by successful organization or specific resources and capabilities have led to sustained competitive advantage. Moreover, MCDA is a framework that focuses on the analysis of complex decision situations and facilitates the sharing of information between stakeholders.

A ranking system is proposed to discern acceptable from unacceptable possibilities. Criteria are ranked according to importance and evaluations are merged to achieve attractive final results. Similarly, MCDA encourages the avoidance of gaps that might occur during the merging of qualitative and quantitative criteria. To calculate performance scores from the information provided by the decision maker, CI is introduced and works as an information aggregator that accepts the coalition of criteria. CI allows decision criteria to be analyzed on a common scale and follow a smallest to largest ranking system, so as to determine the contrast of utilities. The identification of resources and capabilities for CI will be obtained by the decision maker based on four specific categories (*i.e.*, human capital, finance, physical assets, and organization). The decision maker will then score all possible combinations for the four categories of resources and capabilities on a 10-point scale, which can increase or decrease accordingly. The chosen methodology for this dissertation focuses on merging diverse frameworks, which could enlarge the study of strategic management by developing an innovative quantified VRIO.

D. Structure

This dissertation begins with the present introduction, which is dived in five section (*i.e.*, general background, research objectives, methodologies, structure, expected results), to give a broader approach to the varied topics of discussion. *Chapter 1* and *Chapter 2* demonstrate the theoretical and methodological approaches that will be used to achieve a quantified VRIO. The empirical part is based on *Chapter 3* and applies the chosen methodology based on a combination of four frameworks (*i.e.*, RBV, VRIO, MCDA, CI). Specifically, *Chapter 1* aims at expanding the knowledge about the area of strategic management and its evolvement into a multitude of fields, ranking from human-based fields to more abstract theoretical subjects, as well as the constant search for critical internal and external success factors. Consequently, RBV and VRIO are introduced. The VRIO framework can be used as a continuous aid for the evaluation of RBV. Additionally, the limitations of RBV and the VRIO model are presented, as they encounter difficulties when measuring, identifying or

understanding complex or intangible resources. *Chapter 2* introduces MCDA as a supporting tool to the VRIO framework. MCDA favorizes the participation of decision makers and offers more precise information, which RBV and VRIO both struggle to provide. Criteria are organized and ranked conforming to preferences and evaluations are precise to grant clearer final results. Further on, CI is explained and demonstrates its potential in considering criteria coalition. Interrelationships and interconnected criteria can be analyzed by CI, whereas VRIO recognizes a resource as a singular entity. This chapter highlights the limitations of RBV and VRIO that can be improved with the support of MCDA and CI. *Chapter 3* concentrates on the application of CI to improve the VRIO framework. The focus lies on comprehending how the merging of RBV and MCDA creates an outstanding framework, which can offer a quantified VRIO. The selected company – Coliving Factory (CF) – is introduced and deeper observations about its main capabilities and resources are presented. The VRIO postulates of applicability are verified and applied on the most appealing resources and capabilities, given by the decision maker to understand which resources are likely to achieve sustained competitive advantage. For a comparative performance analysis, two main competitors were suggested – The Babel Community (TBC) and La Casa (LC) – and their performance scores were likewise calculated using CI. Furthermore, recommendations for the improvement of CF were proposed according to the final results. The conclusion is divided in three sections (*i.e.*, results and limitations, managerial implications and concluding remarks, and future research).

E. Expected Results

The focal objective of this dissertation is to present a quantified VRIO, which will be obtained by using a unique methodology that merges diversified frameworks. The methodology firstly considers two frameworks that have countless similarities (*i.e.*, RBV and VRIO), and observes their limitations in terms of evaluation and measurement of the combination of quantitative and qualitative resources. MCDA is then considered, as the complexity of conflicting objectives and different types of information can be easily analyzed, which offers a solution for the evaluation of qualitative and quantitative resources. For the calculation of the coalition of criteria, CI is suggested. The coalition of criteria demonstrates the interaction amongst decision criteria and is particularly complicated to analyze when decisions relate to multiple resources and capabilities. One of the goals of this

dissertation is to encourage the full participation of the decision maker to gain more knowledge on the most important resources and capabilities of CF and to receive further information about both competitors, as well as to obtain the subjective scores that are needed for CI calculation.

To the best of our knowledge, this methodology has never been applied before and has been designed based on different frameworks. Hopefully, it will lead to the creation of a quantified VRIO. The objectives of this improved version of the VRIO framework could further on be used as a tool to analyze hybrid results by experts in various fields and, in sequence, enhance strategic management.

PART I

THEORETICAL AND METHODOLOGICAL BACKGROUND

CHAPTER 1

LITERATURE REVIEW

Strategic management was formally introduced almost 60 years ago, as a way of searching for critical factors of success that can be found in the internal or external environment of an organization. Strategic management shed light on various theories that currently count as key pillars for modern business management. However, it has also inspired researchers and academics to create new techniques in a variety of new fields. While strategic management offers infinite possibilities, the focus of this chapter will be on: (1) understanding new trends in strategic management; (2) explaining the resource-based view (RBV) and the VRIO framework, which stands for valuable, rare, inimitable and organization; and (3) understanding the limitations of the VRIO framework, while also presenting suggestions for its improvement.

1.1. New Trends in Strategic Management

The basis of strategic management is founded on managers' ability to understand what makes today's economy (*i.e.*, competitors, markets, financial demands, suppliers, government, shareholders and, most importantly, customers). These various categories represent success factors in a world in constant movement and play a key role in achieving an organization's goals and objectives. Strategic thinking works as a tool to adapt to unexpected conditions that might occur in the future, while strategic plans help to move from a current company's mission to a desired situation (Amoli and Aghashani, 2016).

The foundation of strategic management was created based on the pillar works of Chandler (1962) and Ansoff (1965), among others. Consequently, these authors were helpful in defining important concepts and suggestions regarding strategy, such as: the influence that strategy has on performance; the significance of internal capabilities and external opportunities; and the importance of formulation and implementation of strategies, as well as the key role that managers play in strategic management (Hoskisson *et al.*, 1999).

According to Guerras-Martín *et al.* (2014), the beginning of strategic management started in the 1960s and could almost exclusively be found in publications of authors such

as Chandler (1962) and Ansoff (1965). As a research field, strategic management found its way to evolve and mature thanks to a variety of factors. First of all, there was more diversity in terms of subject matter (Hoskisson *et al.*, 1999) with, for instance, coverage on internalization, competition, different types of strategies, firm cooperation, leadership and corporate social responsibility (CSR) (Rodrigues and Mendes, 2018). Another point noted is the evolution of research methods (Hoskisson *et al.*, 1999; Ketchen *et al.*, 2008). Rather than using case studies, there is access to qualitative tools and hybrid methodologies (*i.e.*, combination between quantitative and qualitative techniques). Indeed, as pointed out by Nag *et al.* (2007: 70), seven key aspects regarding strategic management can be identified in its most recent conceptualizations, namely: *"performance, firms, strategic initiatives, environment, internal organization, managers/owners and resources"*.

To find this out, one needs to identify the factors of success. It has become clear that this vision is shared by many. However, they do not follow the same path due to the fact that this discipline attracts a large variety of researchers, who can range from sociology to economy-related fields. It should also be noted that most of the concepts used as pillars have been created by firms or with help of consultancy agencies (Ford and Mouzas, 2008; Guerras-Martín *et al.*, 2014). An interesting way to explain how complex to find the factors of success can be would be through Mintzberg (*in* Guerras-Martín *et al.*, 2014: 71), who mentioned an old tale by John Godfrey Saxe, in which two blind men analyze the whole body of an elephant by touch. They can't seem to agree on their conclusions as no one was touching the same part, although they were indeed all right in their descriptions. Taking the elephant tale into consideration, it can be concluded that strategic management should not only be seen as one limited field but rather something that can be explained through the theory of the dual pendulum (Hoskisson *et al.*, 1999). On the one hand, this means that strategic management should be focused on *"internal and external consideration"* (Hoskisson *et al.*, 1999: 71). On the other hand, it should be focused on *"macro and micro level consideration"* (Hoskisson *et al.*, 1999: 71). The constant movement of these pendulums through time has brought about the evolution of strategic management as shown in *Figure 1*.

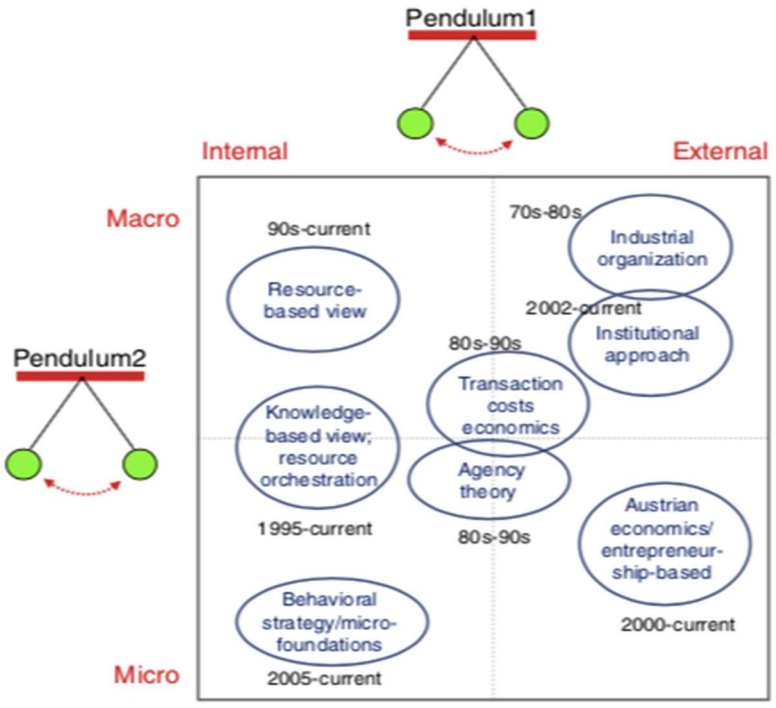


Figure 1: Evolution of Strategic Management Conceptualization

Source: Hoskisson et al. (1999: 71).

Considering the pendulum, Hoskisson *et al.* (1999) tried to describe how strategic management tends to look not only for success factors either inside or outside of firms, but also how the general focus in the 1960s was to understand the strengths and weaknesses inside organizations. During the decade that followed, the focus shifted to the external environment (Porter, 1980). Later on, Wernerfelt (1984) and Barney's (1991) works helped initiate the beginning of the resource-based view (RBV), which focuses on the internal aspect of firms and its dynamic capabilities (Teece *et al.*, 1997). Recently, new approaches to strategic management have been presented, as discussed by Madhok and Marques (2014), who try to demonstrate the competitive aspect of firms, focusing mainly on its will to take action.

The interest is no longer harvested by the position of a firm or how much firms possess, but rather how smaller companies with less advantage are determined to compete with firms of a larger scale (Guerras-Martín *et al.*, 2014). Another example is provided by Garrido *et al.* (2014), who justify the importance of institutions by giving answers regarding strategic management from an institutional point of view (Guerras-Martín *et al.*, 2014). The analysis touches on the subjects of foreign direct investment, diversification and foreign markets, which can be seen as a help to guide researchers when they are in need to implement

institutional elements. Gallardo-Vázquez and Sánchez-Hernández (2014) seem to reinforce this perspective, taking into account the conceptualization of CSR (Guerras-Martín *et al.*, 2014). Complementarily, Epstein and Buhovac (2014) explain how they believe that for sustainable strategy to be adequately implemented, firms require leadership, organizational structure and systems (*e.g.*, environmental management, which uses objectives and strategies and transforms them into something concrete, while demanding feedbacks that will be used for future improvement (Ruokonen and Temmes, 2019).

Furthermore, Sullivan *et al.* (2018) describe the benefits of combining industrial ecology and strategic management concepts to achieve the sustainable development goals, which focus on global issues of *"health, education, social equity and justice, economic security, and environmental issues"* (Sullivan *et al.*, 2018: 237). Improvement in business management and strategic management are becoming mandatory, which allows strategic thinking to achieve a point where stakeholder benefit and environment concern are strongly linked. Prior in strategic management literature, sustainability and environmental management were not considered, and the focus was on internal capabilities and external dynamics to achieve competitive advantage (*e.g.*, Porter, 1979; Wernerfelt, 1984). This point of view shifted with Stuart Hart's natural-resources-based view (NRBV) of the firm, which alters the RBV framework by Wernerfelt (1984). NRBV recognizes strategic advantages for companies, which have occurred from the exchange with the environment. During the XXth century, various business areas have neglected to consider nature and the society in which they occurred. Sullivan *et al.* (2018) believe that it is essential to modify the way of doing business for the greater good of the social-ecological-industrial system. The future of strategic management should acknowledge opportunities for competitive advantage merged with environmentally and sustainable business operation, which will lead to strategical advantages for organizations.

Additionally, the growth of technology and the rise of available information are factors that influence the nature – as well as the rapidity – of new competition (Brown and Eisenhardt, 1995; Stimpert and Duhaime, 1997; Hitt *et al.*, 1998). Most of the time, rivals are determined to surpass others' technological performances. Due to the access to new technology, the focus is shifted on developing groundbreaking advanced technological capabilities. Andersén (2011) expressed how technological discontinuities, as well as hyper-competition (D'Aveni, 1994), represent benchmarks in a contemporary world (Hoskisson *et al.*, 1999).

More recently, international technology transfer has become a new sensation and has been successful for the socio-economic growth of countries. De Moortel and Crispeels (2018) explain how, in terms of strategic management, technology transfer represents a strategic alliance referred to inter-organizational, offering a cooperation between organizations that focuses on sharing, trading or developing products, services and technologies together (De Moorel and Crispeels, 2018). The perks of strategic alliances are the capacity to function as an hybrid *"between market transactions and acquisitions"* (De Moorel and Crispeels, 2018: 147). Furthermore, De Moorel and Crispeels (2018) disclose that to build such an effective technology transfer of strategic alliances, four key pillars of strategic management have to be applied, namely: (1) knowledge base; (2) learning; (3) absorptive capacity; and (4) trust.

Sousa and Rocha (2019a) address the relevance of digital age in strategic management, especially with the extend of social media, blogs and the quick access to any source of information. However, knowledge portals represent a crucial tool for strategic knowledge management, as they offer the access to portals in which employees *"can assess, create, organize, share and use knowledge"* (Sousa and Rocha, 2019b: 223). By using modern technology, knowledge can be further communicated through various folders, reports or images with every employee of an organization. The contemporary use of technology in organizations is not only beneficial to internal factors, but also to external factors such as, for instance, consultants or trade markets (Sousa and Rocha, 2019a).

Furthermore, Kenworthy and Verbeke (2015) offer an alternative option for the future of strategic management, which focuses on improving the quality of borrowing existent theories through a strong selection criteria. Developing a new theory in strategic management has its challenges, as it must be relevant, support various fields and understand that the transfer from concept to a work environment can be complex. Nonetheless, theory borrowing has proved to be a compelling fit between organization and management, as well as a broad field that offers and enhances legitimacy (Fontes *et al*., 2016; Köseoglu *et al.*, 2019).

Kenworthy and Verbeke (2015) believe that time range and theory borrowing content in strategic management have to be limited to after 1980, which allows for a wide time frame, merged with diverse trends and the comprehension of altered theories over time. Köseoglu *et al.* (2019) further explain how scrutinizing the growth of strategic management in broad fields is crucial to further gain in-depth knowledge about theories in different fields and the modern researches, which have been created or modified to achieve sustainable competitive

advantage. However, to assure that a borrowed-theory is applicable, a group of seven "quality tests" are used to assure its relevance and possible entry in the field of strategic management: (1) predictive power; (2) explanatory power; (3) competing theories; (4) issue match; (5) consistent concepts; (6) assumptions match; and (7) knowledge fit (Kenworthy and Verbeke, 2015). Complementarily, the rise of globalization has led organizations to compete in international markets, putting resources and company positions in tougher environments. Additional complexity makes analyses based on a single theoretical framework harder for researchers in the field of strategic management. Therefore, researchers employ multiple theoretical frameworks to better demonstrate global strategic issues (*e.g.*, Hitt *et al.*, 1997; Liu *et al.*, 2018).

Overall, it has become clear that, since the 1960s, strategic management has continued to grow and changed accordingly with the way of doing business. It was also influenced by different economic agents on how to operate and improve their performance from both business and personal perspectives. Nonetheless, according to Pricop (2012), strategic management should engage in a more dynamic approach. Compared to the past, unpredictable factors tend to have a more forceful impact on strategic management theories, due to quick and erratic changes that mark our times. To embrace the modernity of strategic management theory, current trends have to be strongly considered. For instance, sustainability, merging key concepts with market dynamics, and a clearer vision of long-term goals to achieve competitive advantage. This approach can only be considered if new strategic thinking and world economy are thoroughly understood (Pricop, 2012). Furthermore, while strategic management focuses on a variety of subjects, the current focus is on RBV, VRIO framework and respective limitations.

1.2. The Resource-Based View and the VRIO Framework: Baseline Principles

Barrutia and Echebarria (2015) provide a clear insight about RBV by explaining the meaning of the word "resource" and how resources generally represent a benefit or service that a company owns, which will eventually help to achieve a purpose (Fernando and Wah, 2017; Tseng *et al*., 2019). According to Wernerfelt (1984) and Barney (1991), RBV believes that resources are indeed a major force regarding the durability, advancement and performance of an organization, with their focus being on tangible and intangible resources, which can be characterized as valuable, rare and imitable. This, in turn, will lead companies to obtain the

effectiveness that will differentiate them from their rivals (Finney *et al.*, 2008). For RBV to function, two important assumptions have to be considered: organizational resources are heterogeneous and immobile (Rechenthin, 2004; Progoulaki and Theotokas, 2010; Almarri and Gardiner, 2014; Barrutia and Echebarria, 2015; Kull *et al.*, 2016; Mitra *et al.*, 2018). Specifically, as pointed out by Wernerfelt (1984), RBV means that having control or owning a resource is a necessity for gaining competitive advantage in a sector (Almarri and Gardiner, 2014; Barrutia and Echebarria, 2015).

With this in mind, RBV points out that some resources and capabilities can only be produced over a longer period – called "path dependence"; some are ranked in short to medium term category titled "causal ambiguity"; and others can be positioned in the "social complexity" category, which represents the resources and capabilities unable to be sold or purchased (Barney, 2001). When no category fits, the resource or capability might be inelastic in supply (Dierickx and Cool, 1989; Barney, 1991), which can actually be profitable due to the fact that services that cannot be provided, cannot be purchased. Knowing where to position a resource can be a way of achieving a sustainable competitive advantage (Peteraf, 1993; Barney, 2001). As a final thought, Barney (1991) points out that RBV can be understood as a "rich body" of linked but also different instruments that help evaluating where a company stands regarding its sustained competitive advantage. In light of this reasoning, dynamic capabilities become indispensable for firms with a desire to continuously improve their position in their specific market. *Figure 2* represents how dynamic capabilities create a form of valid business model.

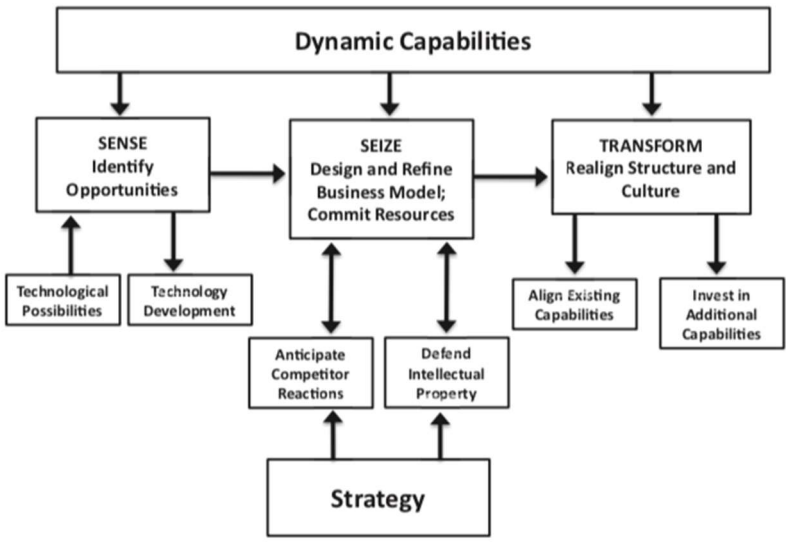


Figure 2: Simplified Schema of Dynamic Capabilities, Business Models, and Strategy

Source: Teece (2018: 44).

Figure 2 shows how dynamic capabilities support three specific RBV pillars, which are: (1) sensing; (2) seizing; and (3) transformation. Sensing will be helpful in terms of finding the right opportunities for a business (*e.g.*, possibilities for improvement in technology). Seizing is linked to every single task of a business model by being in charge of designing and refining a business model when needed, delivering the right resources, as well as always being prepared for rivals' reactions and keeping intellectual property safe. These points are what links strategy and dynamic capabilities together at a business level. Transformation, however, is needed to rearrange in a proper order the structure and culture of a business coupled with keeping existing capabilities, together with constantly seeking to invest in new capabilities (Helfat and Raubitschek, 2018; Kouropalatis *et al.*, 2018; Teece, 2018). Teece (2018) also explains how the ability of demonstrating strong leadership from the position of management is a key element in the dynamic capabilities framework (Jacobides *et al.*, 2006; Teece, 2018). As shown in *Figure 2*, it is important to have an accurate culture inside a company, as well as strive to have shared vision, which should lead to *"organizational identification and loyalty"* (Augier and Teece, 2009). Teece (2018: 48) concludes by affirming that *"business model, dynamic capabilities, and organizational design are mutually interdependent"*.

According to Barney (2014), an organization generates economic importance when the profits gained by its resources and capabilities are higher than the cost of purchasing them in the first place. Logically, companies who fail in terms of creating an economical value are categorized as showing competitive disadvantage. Whenever a company is successful in creating more economic value than its rivals, it has achieved competitive advantage (Cardeal and António, 2012; Lopes *et al.*, 2018). However, this is where the competitive advantage can be ranked either as temporary or sustained. Temporary advantage represents whenever a firm doesn't own the needed resources but is able to get access or develop them without leading to any sort of disadvantage. Sustained advantage is achieved when rivals have to spend a certain amount of cost to get a hand on the requested resources. This is not a lasting situation as changes can occur, for example, in technology or clients' preferences, which then decrease the value of a resource or, worst, extinguishes it. However, RBV does not specialize in defining value but it can offer guidance to better understand whether a resource or capability offers economic value or not (Barney and Mackey, 2016; Lopes *et al.*, 2018).

Value is, however, crucial and essential for the VRIO framework (Barney, 1991). VRIO is used to apply RBV. The framework is divided in four important pillars that help

resources gain sustainable advantage, namely: value; rarity; imitation; and implementation in the organization (Barney and Wright, 1998; Barney *et al.*, 2007). *Figure 3* demonstrates the benefits of applying the VRIO framework to further understand the position of a resource or capability.

Is a resource or capability					
Valuable?	Rare?	Costly to imitate?	Organised properly?	Competitive implications	Firm performance
No	No	No	No	Competitive disadvantage	Below average
Yes	No	No	No	Competitive parity	Average
Yes	Yes	No	No	Temporary competitive advantage	Above average (at least for some amount of time)
Yes	Yes	Yes	Yes	Sustained competitive advantage	Persistently above average

Figure 3: The VRIO Framework

Source: Njoya and Niemeier (2011: 57).

First of all, the VRIO model tries to determine how "valuable" a resource is before jumping into its "rarity" and why a specific capability deserves this title. When these categories have been checked, the framework tacked on the question of "imitability" and why the company stands out from its competitors. The final point, which represents the "O" in VRIO, is to implement strategies smartly so as to increase an organization's profits and, more precisely, the capacity to capture value. The VRIO also helps in understanding where the strengths and weaknesses of an organization are and, more importantly, it tries to use the resources or capabilities that could lead to economic success to become even more competitive (Wernerfelt, 1984; Barney, 1991; Barney *et al.*, 2007). Consequently, if a resource or capability is valuable, rare, inimitable and organized properly, its competitive implications would be ranked as sustained competitive advantage, which symbolizes a consistent above-average firm performance (Aghazadeh, 2015; Lopes *et al.*, 2018). Forthwith, RBV defines that in order to gain competitive advantage, a firm's resources have to be valuable, rare, inimitable and organized on capturing value. According to Cardeal and António (2012), to achieve competitive advantage, organizations need valuable, rare and inimitable capabilities. Cardeal and António (2012) claim that the "O" in VRIO serves as a dynamic capability.

VRIO projects that resources can gain competitive advantage in the internal part of an organization (Barney, 1995 and 1997). However, organization as a term does not seem to be seriously covered in RBV as it is seen as "something else". VRIO is focused mainly on the use or function of the resource itself, therefore even if the main resource is valuable, rare, inimitable, it is argued that if a resource exists that is not rare or easy to copy, the main resource loses its chance of being a source of competitive advantage (Barney, 2001). Regarding dynamic capabilities, however, it is believed that competitive advantage is gained through capabilities, due to the fact that resources in ever-changing markets can lose their value quicker. Not all firms use their resources similarly, no matter how common the resource might be. Knowledge of a firm or finding a way of achieving objectives might be intertwined with these resources. Even though owning tangible or intangible resources represents an important part of a business, it is just as crucial to possess capabilities that allow for the integration and use of these resources (Barney and Wright, 1998; Lopes *et al.*, 2018). Therefore, the "O" can be categorized as a capability and how a company leads a "bundle of resources" (Cardeal and António, 2012; Wong and Ngai, 2019).

Regarding the "V", resources generate value when their usefulness leads to new strategies that are both efficient and effective. However, while some resources might offer services of value, these services might be suppressed until companies are able to have the right capabilities (Newbert *in* Cardeal and António, 2012). Bowman and Ambrosini (2007) explain that resources by themselves are not valuable and have to be combined with activities and capabilities if they wish to gain value (Cardeal and António, 2012). The "R" that stands for rareness has its limitations and, due to the fact that if most rivals are in possession of the same resource, there is a great chance that they will use it likewise, which therefore will not be a source of achieving competitive advantage (Barney and Zajac *in* Cardeal and António, 2012). "I" or inimitability, explains how whenever a resource already fits the first two categories of being valuable and rare but can be copied, meaning that competitive advantage will not be reached (Cardeal and António, 2012; Lopes *et al.*, 2018; Busby, 2019). Furthermore, VRIO framework can be used both as an evaluation, when considering human capital, and a source of sustained competitive advantage. Human capital delivers value in terms of diminishing costs or upgrading productivity. Rareness is met when using the rare knowledge or skills brought by an individual. The incapacity of competitors to imitate the culture of the organization lies within both its anchored history and capacities (Rechenthin, 2004). To make it harder, the resources should be: (1) path dependent (Dierickx and Cool, 1989; Vergne and Durand, 2011); (2) linked to other activities so as to raise their chances of

competitive advantage (Dierickx and Cool, 1989; Reed and Defillipi, 1990; Barney, 1995); (3) socially complex (Barney 1991); (4) have some legal rights tight to its resources (*e.g.*, patents) (Wills-Johnson, 2008); and, last but not least, (5) have a long process of imitation for other companies in terms of the time that is required for the appropriate training for employees or gain the wanted knowledge to handle the resources properly (Wills-Johnson, 2008; Cardeal and António, 2012; Kull *et al.*, 2016). Regarding the last pillar of VRIO, "O", it is understood as the dynamic capabilities of the actual "organization". Even if a resource is valuable, rare and inimitable, troubles seem to arise as ambiguity, path dependency or intangible aspects that create complications. Even though capabilities are being understood, they are still regarded as being inconclusive and mysterious (Reed and Defillipi, 1990; Lado and Wilson, 1994; Cardeal and António, 2012).

The VRIO framework might be useful for resources to achieve sustainable advantage. However, some authors do not believe in the attributes of the VRIO framework and reduce it to the following limitations, namely: (1) VRIO projects the singularity of distinct factors (Black and Boal, 1994); (2) the framework does not meet certain criteria and has been altered for further analysis (Finney *et al.*, 2008); (3) the analysis of inimitable resources is inconceivable; and (4) quantitative approaches represent challenges and lead to the use of outdated methods (Hoskisson *et al.*, 1999). In the next topic, some of the limitations of the VRIO framework are discussed in greater detail.

1.3. Limitations of the VRIO Framework

Barney (1991) believes that by applying the four criteria (*i.e.*, valuable, rare, inimitable and organized properly), the desired features of an organizational resource will be identified easily and lead to sustainable competitive advantage.

Black and Boal (1994) do not agree with Barney's (1991) vision and criticized the VRIO framework, as it fails to consider bundles of resources, and rather acknowledge resources as singularly distinct factors. As a solution, resources should be integrated in a network of distinguished interrelationships, in which there is no need to further inspect the dynamic interrelationships between resources (Grant, 1991; Black and Boal, 1994; Hoskisson *et al.*, 1999). Amit and Schoemaker (1993) decided to enlarge the VRIO framework and created an improved version, as they were not convinced by Barney's (1991) initial model (Hoskisson *et al.*, 1999; Finney *et al.*, 2008). Value was expanded to understand

external factors linked with *"strategic industry factors and internal complementarity"* (Hoskisson *et al.*, 1999: 439). Rareness was mixed with shortage and *"low tradability"*. Inimitability was branched in two categories: *"inimitability and limited substitutability"*. Hence, organization included *"appropriability and durability"* (Hoskisson *et al.*, 1999: 439). Furthermore, initial studies were not differentiating resources from capabilities. Amit and Schoemaker (1993) believe that resources represent assets that are either possessed or controlled by an organization, while capabilities are an organization's ability to take advantage and merge resources during procedures to achieved fixed objectives (Prasad, 2018). Complementarily, Amit and Schoemaker (1993) explain how, even though VRIO should represent a security factor, which maintains sustainable advantage by being hard to copy in terms of organizational assets, only a few represent strategic assets that are useful for competitive advantage (Killen *et al.*, 2012). According to Godfrey and Hill (1995), valuable, rare and inimitable resources are normally intangible and, therefore, complicated in terms of measurement. Godfrey and Hill (1995) believe that it is not possible to evaluate an unobservable, inimitable resource (Hoskisson *et al.*, 1999; Lin *et al.*, 2012).

VRIO is challenging to analyze when it comes to quantitative approaches. RBV suffers from the same challenge, which some researchers have tried to resolve by using, for example, coarse-grained measure (*e.g.*, Chatterjee and Wernerfelt, 1991; Kochhar and David, 1996; Miller and Shamsie, 1996; Hoskisson *et al.*, 1999), or wide data samples (*e.g.*, Markides and Williamson, 1994; Hoskisson *et al.*, 1999). Nevertheless, the complexity of analyzing intangible resources has led researchers to use case studies, field-located studies or samples that stand out (*i.e.*, outlier samples) (*e.g.*, Collis, 1991; Larsson, 1993; Doz, 1996; Hitt *et al.*, 1998; Hoskisson *et al.*, 1999).

Furthermore, even though quantitative methodological analysis appears to be more developed, it has its opposition, as it cannot be applied to all unanswered research questions. McWilliams and Smart (1995) and Priem and Butler (2001) believe that value of resources is obtained by the external environment, more precisely demand and competition, and that sustained competitive advantage is achieved when using resources in a way to attain value for external factors (Maatman *et al.*, 2010). Barney (1991) has been criticized for his belief that ambiguity, which can occur in external environment, is static and not a changing process. In fact, Barney (1991) ignores the *"formal and informal institutional underpinnings that provide the context for competition among industries and firms"* (Kogut *in* Prasad, 2018: 167). In response, McWilliams and Smart (1995) argue that it is not clear enough how VRIO resources could be used to generate value (Maatman *et al.*, 2010).

VRIO is used for organizations that deal with constant competition and quick changes in the environment, which is why knowledge should be a pillar of competitive advantage in a firm. Indeed, it not only leads to new opportunities and problem resolutions, but also works as an intermediary between resources, capabilities, competences, core competences and, finally, VRIO resources (Mahdi *et al.*, 2019). When fresh knowledge is discovered, value is created. When knowledge is not being considered and communication is not flowing between the various stages, there is little chance for valuable, rare, inimitable and organized resources. *Figure 4* illustrates this process.

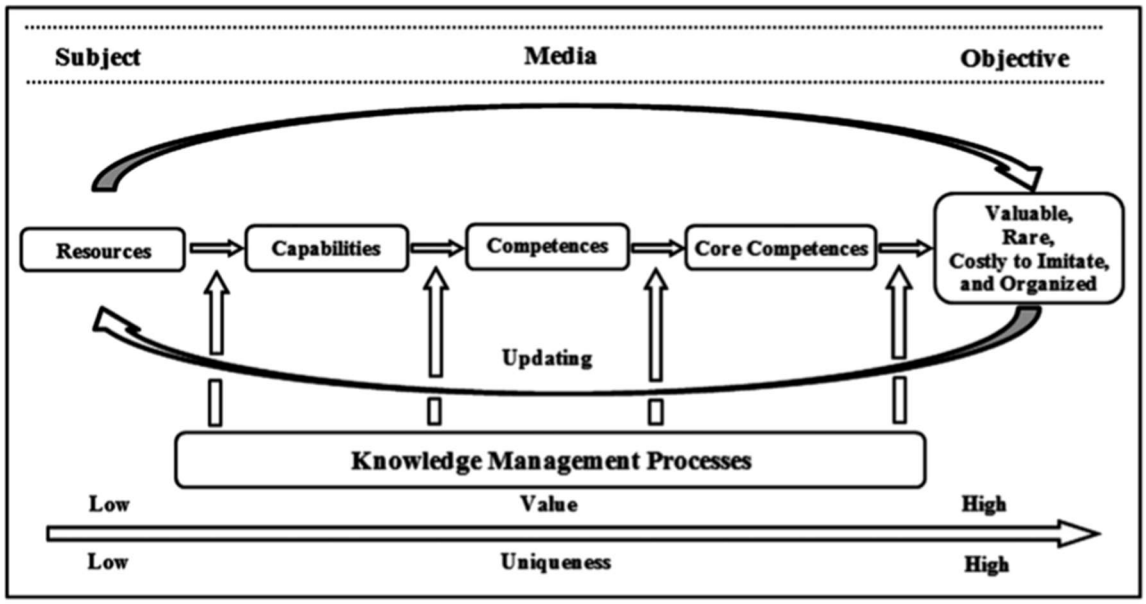


Figure 4: "Theoretical Framework"

Source: Mahdi et al. (2019: 325).

Complementarily to *Figure 4*, Teece *et al.* (1997) and Sirmon *et al.* (2007) explain that being in possession of VRIO resources is not enough to gain sustained competitive advantage, as it is not the resources that generate value, but it is the functionality of the resource and how the resource is employed (Lockett *et al.*, 2009). Sirmon *et al.* (2007) went further as to explain that sustained competitive advantage is only achieved if firms structure their resource portfolio and bundles of resources to create capabilities. Teece and Pisano (1994) demonstrate that by following this approach, capabilities represent a variety of resources that are accurate in organizational structure and support beneficial activities. However, this still does not provide a detailed answer as to how firms can keep their sustained competitive advantage in a changing environment. It is therefore not adequate and,

to achieve sustained competitive advantage, an organization should demonstrate the capacity to continuously create new capabilities (Maatman *et al.*, 2010).

According to Anderson and Narus (1998), value represents the advantage linked to a product or service acquired for a defined price. However, value and price are difficult to analyze as one single entity. Whenever there is a price fluctuation, it does not imply that the value of a product will be affected. However, it might mean that a customer might consider a *"comparative offer"* (Meehan *et al.*, 2017: 230). Additionally, regarding value and price, it is believed that various researchers (*cf.* Bowman and Ambrosini, 2000; Lepak *et al.*, 2007; Priem, 2007; Maatman *et al.*, 2010) differentiate exchange value from use value. Exchange value represent what a customer pays, while use value is focused on a more subjective aspect of the benefits acquired by purchasing a product (Priem, 2007), or a service or quality regarding customers' needs (Bowman and Ambrosini, 2000). According to Sirmon *et al.* (2007), use value is created, therefore, when taking advantage of the capabilities of an organization. However, business factors are constantly affected by the environment. Regarding this matter, capabilities cannot be valuable as its value depends on the circumstances of a purchase and on how it is used further on (Lepak *et al.*, 2007; Maatman *et al.*, 2010).

The VRIO framework tends to not consider quick or unexpected changes, which can occur in hectic environments, and could result in the modification of a strategy formulation. The use of the framework focuses on key factors that demonstrate potential to achieve competitive advantage at a specific time. Consequently, unpredicted turbulences in an environment can occur and managers are highly encouraged to continuously supervise this type of evaluation to understand and maintain an organization's competitive advantage (Lin *et al.*, 2012). Furthermore, according to Barney (2001) and Andersén (2011), being in possession of a valuable, rare, inimitable and organized resource might be a necessity, but does not reflect a satisfactory requirement to clarify an organization's competitive advantage. Complementarily, the authors believe that resources can only meet the desired requirement when merged with the right *"dynamic capability or organizational context"* (Lin *et al.*, 2012: 1398).

Another limitation lies in the uncertainty of perfectly immobile resources, which, according to Dierickx and Cool (1989), can be resources with inadequate rights or peculiar resources that have no credibility or strength outside of a specific organization (Williamson *in* Prasad, 2018).

Lengnick-Hall and Wolff (1999) and Priem and Butler (2001) doubt the application of RBV and VRIO in organizational research. They determined obstacles and believe that the "path-dependent" aspect is only appropriate for stable environments, which represents an unreasonable and naïve factor. To apply these theories would mean to demand internal stability inside an organization and external environmental stability. An option to solve these weaknesses would be to consider dynamic capabilities, as they represent a *"class of organization capabilities that enable organizations to effectively respond to changes in the dynamic environments in which they compete"* (Killen *et al.*, 2012: 527) (see also Eisenhardt and Martin, 2000; Teece *et al.*, 1997; Teece, 2007).

According to Almarri and Gardiner (2014: 440), using the four pillars of VRIO helps managers in *"the subjective method of assessing resources"*, as they offer the possibility to further understanding the benefits of organizational resources and how to achieve sustained competitive advantage. Regarding Barney *et al.*'s (2011) analyses, VRIO and RBV are being criticized for being unstable, as the measurement of resources is rendered complex by some intangible natures. The unfilled gaps of struggling with the measurement of intangible resources complicates the validity and efficiency of forthcoming research projects. To avoid this operational limitation, the link between resources and their interconnections have to be distinguished. Further on, a valid point of criticism is reflected in the issues of generalizability. Generalizability is complex, as it is difficult to precisely understand which factors played a key role in the achievement of outstanding performances leading to the success of an organization. A clear vision about the source that led to competitive advantage has to be established to avoid losing the leading position in a sector. Levitas and Ndofor (2006) explain how trying to operationalize resources and capabilities constitutes a waste of time, as competitive advantage is not located inside specific resources or capabilities, but rather in their interactions and interconnections (see also Almarri and Gardiner (2014)).

Aghazadeh (2015) agrees with Barney's (1991) vision that a sustained competitive advantage will be achieved, as long as it is valuable, rare, inimitable and organized. However, in the current century, business and life in general tend to face more turbulences and quick changes. Regarding those tendencies, VRIO does not seem to be the accurate choice to assure competitive advantage. Correspondingly, product, services, technologies or life cycles are decreasing, which calls for the creation and propagation of innovative knowledge regarding anything related to organizational and operational accomplishment. Furthermore, VRIO struggles to keep up with the quick changes in the environment and can,

therefore, miss opportunities to create desired capabilities to rivals (Aghazadeh, 2015; Napshin and Marchisio, 2017).

Hoskisson *et al.* (1999) address the disadvantages of qualitative-focused approaches. Former scholars used to prefer the use of qualitative analysis, as the focus was mainly on problem-solving, rather than scientific generalization. Most of the analyzes were conducted with wide data samples to examine theories. However, the discovery of RBV and VRIO has created a multitude of issues for researchers, due to its complexity when identifying, measuring or comprehending resources that could be key to success. Accordingly, when using large and secondary data, the results emerge as insufficient, especially when analyzing intangible resources (*e.g.*, corporate culture) (Barney *in* Hoskisson *et al.*, 1999). The combination of the VRIO framework with a different methodology will be proposed and discussed in the next chapter.

SYNOPSIS OF CHAPTER 1

This first chapter aimed to firstly better understand the concept of strategic management and how it has evolved to find its place in various subjects that go from more human-related fields to more theoretical topics, while searching for internal or external success factors. Strategic management has fostered inspiration in many researchers and academics to discover new theories that can currently be measured with quantitative tools opposed to its former way of analyzing theories. While the first topic opens with some theoretical information filled with examples about strategic management, it is then followed by the baseline principles of the RBV and VRIO frameworks. Broadly, RBV was created by Wernerfelt (1984) and Barney (1991) and demonstrates how tangible and intangible resources are crucial in terms of longevity, progress and performance of an organization, focusing on resources that are valuable, rare and imitable. By checking all of these characteristics, companies could achieve sustained competitive advantage and, therefore, differentiate themselves from competitors. Furthermore, dynamic capabilities were explained, as they represent a way for improving an environment by integrating, building and reconfiguring internal competences. In addition, the VRIO framework is seen as a helpful tool to further analyze RBV. VRIO stands for valuable, rare, inimitable, organization – or, more specifically, to capture value by an organization. VRIO tries to use the resources and capabilities of an organization that show potential and can, therefore, lead to sustained competitive advantage. Nonetheless, it has to be understood that VRIO has its share of limitations. For example, Lin *et al*. (2012) believe that VRIO is not the most adequate framework to apply in turbulent environments and its four attributes do not assure competitive advantage. Killen *et al*. (2012) further demonstrate how VRIO demands internal and external stability in a hectic environment, which could only be solved with the aid of dynamic capabilities. Furthermore, Almarri and Gardiner (2014) describe the complexity of measuring intangible resources and how interconnections have to considered. Aghazadeh (2015) and Napshin and Marchisio (2017) explain that VRIO is not built to face turbulent environments and calls for innovation to achieve organizational and operational achievement. Furthermore, Hoskisson *et al.* (1999) strongly believe that qualitative analyzes do not offer the best solution, as they face dilemmas when examining intangible resources, located in primary or secondary data. In the next chapter, multiple criteria decision analysis (MCDA) will be introduced and discussed in order to complement and support the VRIO framework.

CHAPTER 2

METHODOLOGICAL BACKGROUND

Multiple criteria decision analysis (MCDA) presents a methodical and improved way for managing complex decisions. MCDA is focused on the participation of decision makers, encourages constructivism and favors the inseparability of subjectivity and objectivity in the decision-making process. The focus of this chapter will be on: (1) the basic concepts and fundamental convictions of the MCDA approach; (2) the possibility of a combination of MCDA and the VRIO framework; (3) the fundamentals of the Choquet integral (CI); and (4) the contributions that CI may bring to VRIO.

2.1. MCDA: Basic Concepts and Fundamental Convictions

According to Belton and Stewart (2002), creating a structure for complex decision issues and acknowledging multiple criteria will lead to improved and clearer decisions. Multiple criteria decision aid has progressed since its beginning in the 1960s, with, for example, the development of two strong branches, multiple criteria decision making (MCDM) and multiple criteria decision analysis (MCDA). The two branches may have their differences, but share a common vision about facilitating decisions (*cf.* Roy, 1985; Roy and Vanderpooten, 1997; Ormerod, 2013; Santos *et al.*, 2017; Carayannis *et al.*, 2018; Ferreira *et al.*, 2019).

Complementarily, Belton and Stewart (2002) express how MCDA was categorically created as an aid for the evaluation of alternatives with clashing objectives (Marttunen *et al.*, 2017; Tröster and Hiete, 2019). MCDA concentrates on supporting complex decision-making situations with various and generally conflicting goals, which might have different significance for the decision maker (Belton and Stewart, 2002; Zanghelini *et al.*, 2018; Saarikoski *et al.*, 2019). The evaluation process can be used in different forms. For example, the selection of alternatives based on subjective preferences, a ranking from best to worst, the arrangement of alternatives in "good" or "bad" categories, etc. (Durbach and Stewart, 2012). Furthermore, Morais and Almeida (2006) describe how MCDA can be used as a tool

to determine specific criteria and offer fundamental choices amongst the evaluated alternatives (Castellini *et al.*, 2012). The focus of this chapter will be to further understand the basic concepts of MCDA and its fundamental convictions.

The increased complexity organizations and individuals face has led decision makers to ask for advanced methodologies that would ease the process of making decisions. Decision-making systems responded by integrating analyses about performance and identifying the critical factors of success based on multiple criteria. Keeney (1996) established value-focused thinking (VFT) as a mean to create valuable tools that would help in the structure and evaluation of complex decision situations, as this analysis is based on the expertise, experience and the values of researchers in specific fields (Keeney, 1996; Ferreira *et al.*, 2019).

Belton and Stewart (2002) and Ferreira *et al.* (2011) define how MCDA is based on three VFT fundamental convictions, namely: (1) *"learning through participation"*, as all parties involved should be engaged in the learning process; (2) *"constructivism"*, where transformations that occur in the decision-making analysis are taken into consideration and advanced solutions are created; and (3) *"the inseparability of objective and subjective aspects"*, which focuses on the integration of objectivity and subjectivity in the decision-making process, also referred to as *"specialized know-how and sensemaking"* (Gonçalves *et al.*, 2018: 484). Furthermore, Belton and Stewart (2002) describe how the phases that occur during MCDA are or consist of: (1) focused on the identification and structuring of the decision problem, as well as on the alternatives and decision criteria; (2) predicting the achievement of alternatives regarding each criteria (*i.e.*, scoring); (3) understanding decision makers' preferences (*i.e.*, weighting); (4) creating an mathematical evaluation of the outcome performance; and (5) demonstrating the awareness of the changed results that occurred, due to the framework (Saarikoski *et al.*, 2019).

MCDA *"is suitable for addressing complex problems featuring high uncertainty, conflicting objectives, different forms of data and information"*, which makes it an accurate tool to use for when analyzing complex qualitative and quantitative resources (Oliveira *et al.*, 2018: 68) (see also Durbach and Stewart (2012) and Domingues *et al.* (2015)). Ensslin *et al.* (2000) share the common vision that creating conversations between the involved parties leads to a learning process, which will further create a valuable contribution to the decision analysis. These dialogues generate objective and subjective decision criteria, which are equally evaluated and used for the decision-making process so as to have a better, more

information comprehension of the process. *Figure 5* demonstrates the framework related to the MCDA approach (Gonçalves *et al.*, 2018).

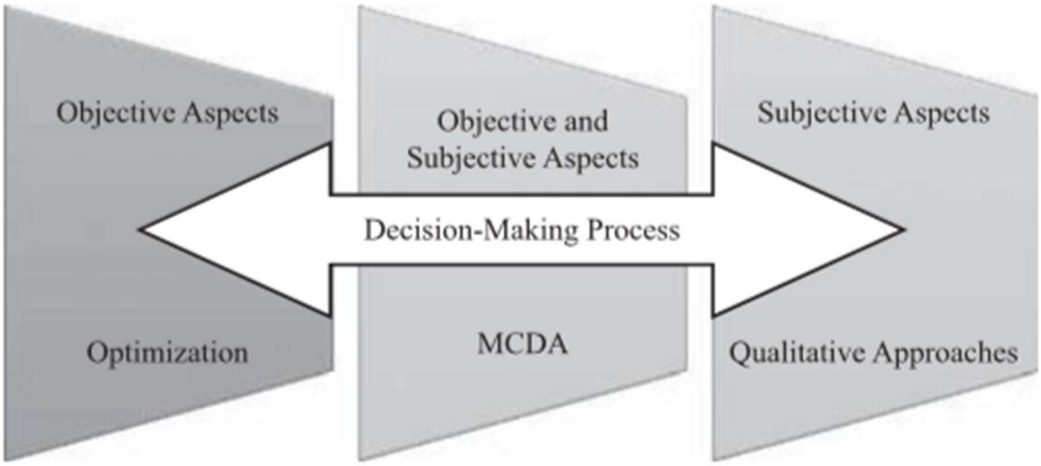


Figure 5: The MCDA Approach

Source: Ferreira et al. (2011: 117).

The framework presented in *Figure 5* integrates three key phases: (1) structuring; (2) evaluation; and (3) recommendations (*cf.* Bana e Costa *et al.*, 1997; Zopounidis and Doumpos, 2002; Xu and Ouenniche, 2012; Bana e Costa *et al.*, 2014; Carayannis *et al.*, 2018; Gonçalves *et al.*, 2018). However, these three phases are not seen as a single entity, but rather as interconnected, which reduces the risk of gaps that could have a negative impact on the final outcomes (Gonçalves *et al.*, 2018; Morente-Molinera *et al.*, 2020).

The structuring phase focuses, for example, on: (1) the selection of the decision makers who should represent capable experts; (2) the *"trigger question"*, which helps to understand the topic under study; and (3) the definition of relevant criteria and their cause-and-effect relationships. The evaluation phase focuses mainly on the trade-offs obtained between evaluation criteria, and the influence of value attributes of decision makers. The trade-offs among criteria are achieved with the aid of decision makers who rank criteria according to their relative importance. The recommendation phase argues that the work produced should be process-oriented, rather than focused on outcomes. It is a learning process, and not a final result or a method to find the best solution. However, the results are dependent of the actors and the context in which the analysis occurred (Ferreira *et al.*, 2012; 2014a and 2014b; Domingues *et al.*, 2015; Oliveira *et al.*, 2018).

Furthermore, MCDA demonstrates that allowing decision makers to rank criteria based on subjective preferences leads to a more pleasant and structured framework for future decisions. Additionally, decision makers share information about their preferred options, and can continuously modify alternatives and criteria, as they are not fixed. Therefore, decision making processes are heterogeneous and dynamic (Morente-Molinera *et al.*, 2020). While both qualitative and quantitative analyses can be performed with MCDA, the VRIO framework requires improvement regarding quantitative analysis, which will be further demonstrated in the next topic.

2.2. MCDA and the VRIO Framework: A Win-Win Situation?

The VRIO framework is a useful tool to understand whether a resource or capability is valuable, rare, inimitable and organized properly, so as to achieve sustained competitive advantage and create an above-average firm performance. Nevertheless, VRIO has received various critical analyses from numerous authors.

According to Black and Boal (1994), VRIO has some limitations in terms of considering resources as singular distinct factors, while resources are indeed interconnected (Black and Boal, 1994; Grant, 1991; Hoskisson *et al.*, 1999). Godfrey and Hill (1995) share the common vision that resources that are valuable, rare and inimitable are commonly intangible, which is complex to measure. The authors believe that inimitable resources are, therefore, impossible to evaluate (Hoskisson *et al.*, 1999; Lin *et al.*, 2012). Furthermore, one of the most criticized aspect of the VRIO framework would be that it is challenging to use for quantitative approaches. Various authors have tried to solve this challenge with different methods. For example, by collecting large data samples (*e.g.*, Markides and Williamson, 1994; Hoskisson *et al.*, 1999). However, due to the intangible nature of some resources, scholars have been limited their research to case studies or outlier samples (*e.g.*, Collis (1991); Larsson (1993); Doz (1996); Hitt *et al.* (1998); Hoskisson *et al.* (1999)). Complementarily, Mahdi *et al.* (2019) addressed how, whenever knowledge is not taking into consideration and communication is lacking, sustained competitive advantage may probably not be achieved. Furthermore, Teece and Pisano (1994) criticize how there is not enough transparency regarding how organizations can keep its sustained competitive advantage in an everlasting changing environment. Organizations should thrive for the continuous creation of new capabilities, which is not limited to a singular entity (Maatman

et al., 2010). In view of the limitations of the VRIO framework, MCDA offers various solutions that could resolve some of VRIO's shortcomings.

According to Belton and Stewart (2002), some of the inherent characteristics of MCDA would be: (1) the consideration of multiple, complex criteria; (2) the aim to structure and resolve management problems; (3) the creation of a model that can be used during dialogues between decision makers; and (4) rational, understandable and explicable final decisions (Mendoza and Martins, 2006; El-Hanandeh and El-Zein, 2010). Furthermore, as already pointed out, MCDA follows three fundamental convictions: (1) *learning through participation*; (2) *constructivism*; and (3); *the inseparability of objective and subjective aspects* (Ferreira *et al.*, 2011; Gonçalves *et al.*, 2018). Those convictions could offer a solution regarding the rather detached and more objective approach of the VRIO framework, as decision makers and respective subjectivity are crucial when applying MCDA.

Mendoza and Martins (2006) describe how MCDA is capable to use a mix of data, whether quantitative or qualitative, and favors the point of view of experts. The gap between knowledge and information are filled due to the qualitative data, the opinion of experts and the knowledge of specialists. Furthermore, the structure allows for a cooperative planning and a pleasant decision-making climate. Due to the encouraged participation that MCDA praises as a fundamental conviction, experts and stakeholders are constantly, actively involved. Complementarily, Ram *et al.* (2011) and Golmohammadi and Mellat-Parast (2012) consider that whenever strategic tasks are evaluated, MCDA surpasses other approaches, as it is able to handle qualitative and quantitative purposes (Dehe and Bamford, 2015; Domingues *et al.*, 2015). Additionally, Dehe and Bamford (2015) describe how MCDA offers a suited framework to help with complicated decision situations and supports the sharing of information between stakeholders. Problems are structured, criteria are ranked in terms of importance and preferences, and alternatives are combined so as to give approval to final decisions (Saaty, 1980; Yang, 2001; Dehe and Bamford, 2015).

As stated by Linkov and Seager (2011) and Shields *et al.* (2011), there are different ways of applying MCDA, each with their own framework, which offers a broad variety that is not limited to the four dimensions of VRIO. These ways can be either simple and demand limited information or require a mathematical programming approach that requests expanded information, as well as decision-makers' preferences (Greening and Bernow, 2004; Zanghelini *et al.*, 2018). According to Belton and Stewart (2002), an advantage of MCDA is that it provides different benefits, which can be utilized to discover the highest

preferred options, to have access to a ranking system, and to group or understand *"acceptable from unacceptable possibilities"* (Zanghelini *et al.*, 2018: 611).

Nonetheless, a limitation identified by Mendoza and Martins (2006) is that MCDA can be questionable, when considering participation in a decision-making climate from actors who focus solely on their interest and values. Roy (1985) present an alternative paradigm, best known as *Soft Systems*, that meets these limitations. The characteristics are as follow: (1) create alternative options that are satisfactory and don't require further trade-offs; (2) less data due to the merging of hard and soft data, as well as civil judgement; (3) transparency and absence of complications; (4) active participation from people; (5) facilitation regarding planning; and (6) the understanding that uncertainty occurs, so as to not close the door on options. Belton and Stewart (2002) also tackle on soft methods, also known as soft-operational research (*i.e.*, Soft OR) (Mendoza and Martins, 2006).

According to Zeleny (1982), MCDA was established with the outranking method Elimination and Choice Expressing Reality (ELECTRE), created by Bernard Roy, which focuses on the facilitation of decision-making processes (Guitouni and Martel, 1998; Castellini *et al.*, 2012). Although MCDA offers a wide possibility of methods, all of them share the common basis that *"most decisions and decision-making can be improved by decomposing the overall evaluation of alternatives into evaluation on a number of usually conflicting criteria relevant to a problem"* (Durbach and Stewart, 2012). Domingues *et al.* (2015) justify how MCDA is needed to offer transparency, when analyzing accumulating, complex information, which are filled with both qualitative and quantitative data. According to Lahdelma *et al.* (2000), MCDA methods can be predominantly classified in two categories: (1) utility or value-function methods; and (2) outranking methods (El-Hanandeh and El-Zein, 2010).

Complementarily, nearly every MCDA method considers the decision makers' preferences as pillar to propose recommendations. The choices made by decision makers, therefore, influence the MCDA process and the outcome (Guitouni and Martel, 1998). Any MCDA method shares one of the following attributes: (1) *compensatory*: a total compensation between evaluations occurs. One pleasant criteria performance can outbalance a deficient one. This category fits for weighted sum; (2) *non-compensatory*: the compensation between different elements is categorially declined. Due to important dimensions, the decision maker can decide to reject compensations or trade-offs; (3) *partially compensatory*: some type of compensation is welcomed between the various criteria or dimensions. This represents the most common category for MCDA methods. The

difficulty lies in the evaluation of compensation between each other (Guitouni and Martel, 1998).

Considering the vast options of MCDA methods, Guitouni and Martel (1998) mention the concepts of multi-attribute utility theory (MAUT) and multi-attribute value theory (MAVT). MAUT and MAVT represent methods, which conform with *"the single synthesizing criterion approach"* (Guitouni and Martel, 1998: 506). These methods can be ranked as utility or value-function methods and describe how a specific function can represent the decision makers' preferences. The analyst focuses on the assignment of the elected function, which allows for a forthright ranking of the alternatives.

The analytic hierarchy process (AHP) method is another commonly-used MCDA method. AHP was developed by Saaty (1980) and focuses on pairwise comparisons, which are analyzed with a semantic and ratio scale to determine the decision makers' preferences (Guitouni and Martel, 1998; Abastante *et al.*, 2019; Benmoussa *et al.*, 2019; Carra *et al.*, 2019; Lai and Ishizaka, 2019). The AHP represents a *"single synthetizing criterion approach"* (Guitouni and Martel, 1998: 506). According to Saaty (2008), AHP is based on pairwise comparisons, but it is the judgement of decision makers that determine priority scales, which asses intangibles in related terms. The AHP method uses comparison matrices, where specific pair-wise comparisons of alternatives and criteria are given by the decision maker on a nine-level verbal scale, which ranges between "equal importance" to "extreme importance". The calculation of weight occurs with the use of the eigenvalue method created by Saaty (1977). Furthermore, according to Saaty (*in* Carra *et al.*, 2019: 716), two restraints exist when considering alternatives: *"a) the number of alternatives must be lower than nine for two reasons (i) a simpler evaluation for the personnel who gives judgements and (ii) computational efficiency; (b) the alternatives must represent real cases"*.

Opricovic (1998) presented the VIKOR method to enhance multi-criteria in complex systems. VIKOR focuses on the ranking of various alternatives faced with the existence of conflicting criteria. The VIKOR method offers a multi-criteria ranking system, which focuses on the closest measurement to the optimal solution (Fancello *et al.*, 2019). The technique for order preference by similarity to an ideal solution (TOPSIS) represents another generally-applied MCDA method (Hwang and Yoon, 1981; Fancello *et al.*, 2019). The focal point of this method is that the most appealing compromise alternative should be as close as possible to the ideal solution, while the least desired alternative should be at the furthest distance (Santos *et al.*, 2017; Fancello *et al.*, 2019).

Measuring attractiveness by a categorical-based evaluation technique (MACBETH) is an MCDA method created by Carlos Bana e Costa and Jean-Claude Vansnick and represents an interactive technique that helps to create numerical ranges of intervals, so as to quantify the judgements and the differences of appeal according to the decision maker. It is a useful tool for value functions and, likewise, for trade-offs amongst criteria in an evaluation model (Faria *et al.*, 2018).

In spite of the vast number of MCDA methods, no method is considered superior to another or convenient for all decision-making processes (Guitouni and Martel, 1998). Consequently, considering the multitude of MCDA methods that are able to deal with interconnected criteria, the Choquet integral (CI) will be adopted. This method allows for the modelling of interactions between criteria (*i.e.*, fuzzy measure) and accredits a weight to each criteria and subset of criteria (Corrente *et al.*, 2016; Moghtadernejad *et al.*, 2019). CI represents one of the most generally-used methodology when managing interactions between criteria, due to its tractability and understanding of preferences and by even being comprehensive for non-expert decision makers (Corrente *et al.*, 2016).

CI is a suited option when decision criteria are interconnected and demonstrates the following advantages: (1) can be used for single or various-dimensional decision-making situations; (2) is not mathematically demanding; (3) is able to handle uncertainties; and (4) accepts interactions between criteria (Moghtadernejad *et al.*, 2019). Complementarily, CI can be merged with various MCDA methods to assess preferences and considers quantitative and qualitative criteria. Following this, it seems clear that, in contrast to VRIO, MCDA has the possibility to fill the gaps between the qualitative paradigm and the more rational quantitative paradigm. The next subject matter will focus on the fundamentals of CI and how the VRIO framework could benefit from its combined application.

2.3. Fundamentals of the Choquet Integral

The Choquet integral (CI) was developed by Gustave Choquet in 1953 and can be described as a *"non-additive MCDA operator"* (Choquet, 1953; Sansa *et al.*, 2019; Shieh *et al.*, 2009; Ferreira *et al.*, 2018). CI can be used whenever *"aggregation of partial scores by conventional additive measures is not possible due to criteria coalition"* (Ferreira *et al.*, 2018: 492). The coalition of criteria, which represents the interaction and synergy between

decision criteria, can be complex, especially regarding ambiguous situations between stakeholders or regarding the alignment of common objectives and visions.

Rational processes that occur when making decisions are typically based on evaluation criteria. However, one must bear in mind that criteria are mostly interdependent and interact among each other. Therefore, partial evaluations are not able to be combined with regular additive measures (Grabisch, 1996; Grabisch *et al.*, 2003; Bottero *et al.*, 2018; Ferreira *et al.*, 2018). There are, however, different methodologies to deal with this issue, which can be referred to as non-additive measures (NAM) and represent a useful tool to visualize various sorts of interactions that meet the preferences of decision makers. Grabisch (1996) explains that CI is a fuzzy integral method, which demonstrates a model for multicoalition of criteria. Following this, CI focuses not only on a single criterion, but on a variety of decision criteria.

Mathematically, if *n* represents the number of decision criteria, CI demands a 2^n parameter, that represents all the potential combinations of the *n* criteria (Krishnan *et al.*, 2015; Estêvão *et al.*, 2019). 2^n represents all the subsets of the set of criteria in *N*. Furthermore, according to Choquet (1953), Shieh *et al.* (2009), Tan and Chen (2010), Ferreira *et al*. (2018), Brito *et al*. (2019) and Silva *et al*. (2019), a fuzzy measure – or also referred to as capacity – of *X* can be explained as the set function μ: $P(X) \rightarrow [0,1]$ (Estêvão *et al.*, 2019). This set function should satisfy conditions (1) and (2):

$$\mu(\phi) = 0;\ \mu\ (X) = 1 \text{ (boundary condition)} \quad (1)$$

$$If\ A, B \in P(X)\ and\ A \subseteq B, then\ \mu\ (A) \text{ (monotonicity condition)} \quad (2)$$

Krishnan *et al.* (2015: 428) describe how the boundary condition illustrates *"that an empty set, with the absence of any attributes, has no importance where* $g\ \{\phi\} = 0$ *and the maximal set, with the presence of all attributes, has maximal importance where* $g\ \{C\} = 1$*"*. The monotonicity condition indicates that including new attributes to a subset or combination will not diminish its significance (Krishnan *et al.*, 2015; Hu and Chen, 2010).

Regarding conditions (1) and (2), Grabisch (1996) and Angilella *et al.* (2004 and 2010) note that the value $\mu(S)$, which is obtained by the fuzzy measure μ on the set of criteria S, is linked to the weight accustomed by the decision maker to the criteria set of S. Therefore, a fuzzy measure can be contemplated as additive if $\mu(S \cup T) = \mu\ (S) + \mu\ (T)$, for any

$S, T \subseteq N$, so that $S \cap T = \phi$, which implies that no interaction is conceivable between the criteria and the linear hypothesis is valid. However, if a fuzzy measure is determined as non-additive, it may be super-additive, if $\mu(S \cup T) \geq \mu(S) + \mu(T)$ or sub-additive considering that $\mu(S \cup T) \leq \mu(S) + \mu(T)$ (Grabisch, 1996; Tsai and Lu, 2006; Krishnan *et al.*, 2015; Ferreira *et al.*, 2018). Ralescu and Adams (1980) demonstrated that μ can only be considered if conditions (3) and (4) are respected (Estêvão *et al.*, 2019). *Figure 7* illustrates the geometrical conceptualization of CI.

$$\{A_n\} \subseteq P, A_1 \subseteq A_2 \subseteq \cdots \subseteq A_n \in P \Rightarrow \mu\left(\bigcup_{n=1}^{\infty} A_n\right) \lim_{n \to \infty} \mu(A_n) \quad (3)$$

$$\{A_n\} \subseteq P, A_1 \supseteq A_2 \supseteq \cdots \supseteq A_n \in P \Rightarrow \mu\left(\bigcap_{n=1}^{\infty} A_n\right) = \lim_{n \to \infty} \mu(A_n) \quad (4)$$

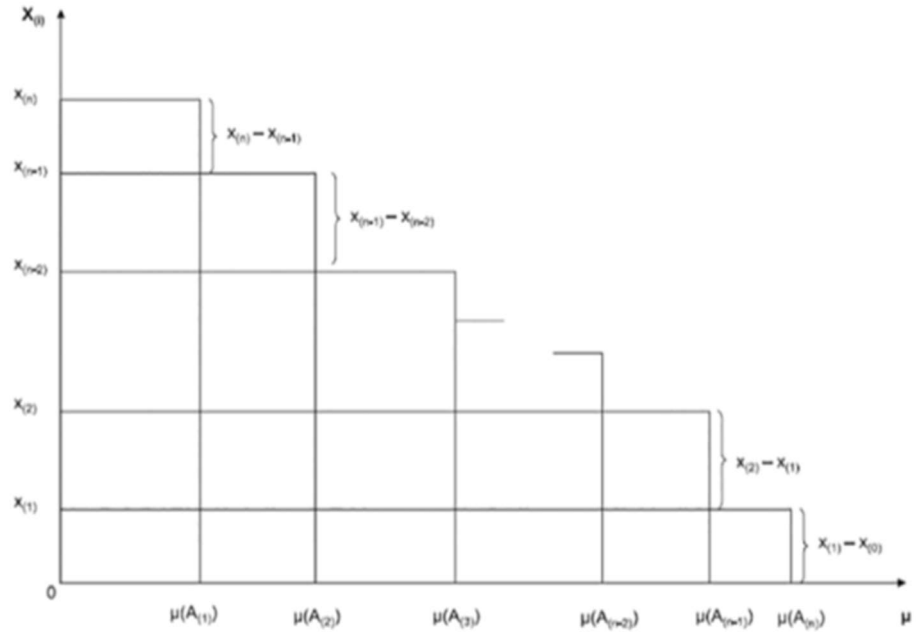


Figure 6: Geometrical Representation of the Choquet Integral

Source: Bottero et al. (2014: 28).

Wang (2011) and Brito *et al*. (2019) note that μ represents a submodular non-additive measure if $\mu(A) + \mu(B) \geq \mu(A \cup B) + \mu(A \cap B)$, and that it is a super-modular non-additive measure if $\mu(A) + \mu(B) \leq \mu(A \cup B) + \mu(A \cap B)$, for any $A, B \subseteq P$. The CI of f that is linked to μ in A is defined as $(C) \int_A f du$ (Ouyang and Li, 2004; Estêvão *et al.*, 2019) (see formula (5)).

$$(C)\int_A f du = \int_O^{\infty} \mu\,(A \cap F\alpha) d\alpha \tag{5}$$

Consequently, *f* symbolizes a non-negative, measurable function of real value found in *X* and $F\alpha = \{x\, f(x) \geq \alpha\}$, for $\alpha > 0$. Nevertheless, if (X, P, μ) is a fuzzy measure along with $\{f_1, f_2, \ldots f_n,\} \subseteq F$ and $A, B \in P$, then *Fx* represents a set filled with all non-negative measurable functions of real value found in *X.* Wang (2011) demonstrates principles (6) to (11) (Estêvão *et al.*, 2019).

$$if\ \mu(A) = 0, then\ (C)\int_A f du = 0 \tag{6}$$

$$(C)\int_A c d\mu = c.\mu(A) \tag{7}$$

$$if\ f_1 \leq f_2, then\ (C)\int_A f_1 du \leq (C)\int_A f_2 du \tag{8}$$

$$if\ A \subset B, then\ (C)\int_A f du \leq (C)\int_B f du \tag{9}$$

$$(C)(f + c) d\mu = (C)\int_A f du + c.\mu\,(A) \tag{10}$$

$$(C)\int_A c.f du = c.(C)\int_A f du \tag{11}$$

Wang (2011) further explains that CI incorporates a set that is monotone, non-additive and non-linear, which regarding to non-additive measures in the case of CI. In this regard, the most important property is presented in formulation (12) (Estêvão *et al.*, 2019).

$$(C)\int_A (f + g) d\mu \neq (C)\int_A f d\,\mu + (C)\int_A g d\mu \tag{12}$$

Moreover, Murofushi and Sugeno (1991) believe that the monotone property of CI can be demonstrated with formula (13) (Murofushi and Sugeno, 1991; Grabisch *et al.*, 2008; Shieh *et al.*, 2009; Estêvão *et al.*, 2019).

$$(C)\int_A f d\mu \leq (C)\int_A g d\mu, when\ f \leq g \tag{13}$$

According to Krishnan *et al.* (2015), Ferreira *et al.* (2018) and Brito *et al.* (2019), a crucial characteristic of CI is its strength in managing the coalition of criteria, which offers more knowledgeable and rational results that aid for the collection of key information. CI is able to model variables interdependency. However, according to Demirel *et al.* (2010), even if CI has its share of weaknesses, it shows outstanding performance regarding complex decision problems that arise when merging qualitative and quantitative criteria (Demirel, 2010; Estêvão *et al.*, 2019).

CI differentiates itself from regular weighted criteria methods, where a weight is linked to a specific criterion by cause of being focused on capacities that accredits a global weight $\mu(T)$ to each subset (T) of a set of criteria (G/T). It can be understood that, whenever $\mu(T)$ is different than the sum of weights $\mu(\{g_i\})$ that belongs to (T), it represents an interaction between decision criteria. However, only a limited number of criteria should be considered, as an extensive number of criteria is too complex to interpret for decision makers (Bottero *et al.*, 2018). The following examples demonstrate how by taking two decision criteria g_i and g_j, the following options can arise (Bottero *et al.*, 2018):

- $\mu(\{g_i, g_j\}) = \mu(\{g_i\}) + \mu(\{g_j\})$: no interaction among the pair of criteria g_i and g_j.
- $\mu(\{g_i, g_j\} > \mu(\{g\_i\}) + \mu(\{g\_j\})$: mutual-strengthening effect (*e.g.*, synergy) among the pair of criteria g_i and g_j.
- $\mu(\{g_i, g_j\} < \mu(\{g\_i\}) + \mu(\{g\_j\})$: mutual-weakening effect (*e.g.*, redundancy) among the pair of criteria g_i and g_j.

For the application of CI, two fundamental conditions have to be considered, namely: (1) utility values should be designated on a common interval scale to criteria performances; and (2) a ratio scale is used to grant a numerical value $\mu(T)$ to each subset (T). Accordingly, one of the fundamental requirements of CI demands that the utilities of criteria are on a common scale. Therefore, it is a necessity to first rank the utilities of criteria from smallest to largest and then calculate the differences of utilities on the various criteria (Bottero *et al.*, 2018). Furthermore, according to Krishnan *et al.* (2015), CI is not only able to deal with interconnected decision criteria, but also offers transparent results, which can help to resolve complex decision problems (Brito *et al.*, 2019). Additionally, Brito *et al.* (2019) express a benefit of CI, which is its ability to combine qualitative and quantitative criteria and manage

their interdependence throughout the aggregation of cardinal information, resulting in realistic outcomes. The following topic will introduce the possible contributions that CI could offer to quantify the VRIO framework.

2.4. Potential Contributions of the Choquet Integral to a Quantified-VRIO

According to Büyüközkan *et al.* (2009), the verification of criteria interdependence is limited in the traditional VRIO framework. To further understand the interaction of criteria, it is critical to comprehend the importance of a certain criterion, as well as its interactions with other criteria (Grabisch, 1997; Marichal and Roubens, 2000; Büyüközkan *et al.*, 2009). This can be interpreted according to the set function μ, referred to as Choquet capacity (Choquet, 1953; Ferreira *et al.*, 2018) or fuzzy measure (Murofushi and Sugeno, 1991; Grabisch and Labreuche, 2005a and 2005b; Büyüközkan *et al.*, 2009). Therefore, when using CI, scholars are able to interpret more precisely the variety of behaviors of decision makers, as well as the significance and synergy in the decision criteria (Grabisch, 1997; Büyüközkan *et al.*, 2009).

The clarification – or, more precisely, the elucidation – of the aggregation is an aid for the decision maker throughout the process of decision making. Understanding the "how" and "why" in the elucidation is crucial when taking decisions and has the ability to offer a merged qualitative and quantitative response. The "why" delivers a quantitative response that indicates the impact or influence of specific criterion fulfillment (Dasarathy, 2000; Berrah *et al.*, 2008; Büyüközkan *et al.* 2009).

According to Gomes *et al.* (2013), when applying CI, several benefits can be obtained, namely: (1) it diminishes the need for further calculations for *raw data*; (2) exact values and interval values can be considered; and (3) more complicated additive models can be adopted that should consider the interdependence among criteria. Furthermore, Greco *et al.* (2011) express that when analyzing a decision, criteria are evaluated, which represent a set of alternatives merged with various points of view. An example given by Angilella *et al.* (2004) and Greco *et al.* (2011) considers a car and its various criteria: maximum speed, price, acceleration, and fuel consumption. To be able to make a decision, the aggregation of evaluation regarding various criteria should be executed. The MCDA approach can be applied with numerous methodologies. A simple option would be the weighted average method, while some more complex methods can be considered, such as CI, due to its

consideration of the interactions between criteria. A set of criteria can be small or big but should consider redundancy and synergy inside criteria. Taking the example of the car, redundancy can be observed when combing speed and acceleration, as fast cars usually don't lack in terms of acceleration; while synergy in terms of maximum speed and price are demonstrated, as fast cars tend to be pricier (Greco *et al.*, 2011).

According to Angilella *et al.* (2004), the advantages delivered with CI are that it can consider both positive and negative interactions among criteria, and decision makers can give minimum information and, voluntarily, express the level of subjective importance or pointing out to interaction of certain criteria. Angilella *et al.* (2004) believe that while CI is stable and can be implemented quickly, it has to be considered that it employs a large size of options. The authors encourage further research to adopt *"high quality solutions for real-world multicriteria decision problems"* (Angilella *et al.*, 2004: 743).

A brand-new way of applying CI would be to create a combination of CI and the VRIO framework, resulting in a quantified-VRIO. According to Wernerfelt (1984), Barney (1991) and Barney *et al.* (2007), VRIO offers a better understanding of an organization's strengths and weaknesses and where its resources and capabilities can be operated so as to generate economic success. If all these categories are respected, a resource or capability can be ranked as a sustained competitive advantage and, therefore, have an above-average firm performance. Nevertheless, VRIO does not consider interrelationships between resources and considers each resource as a singular element (Grant, 1991; Black and Boal, 1994; Hoskisson *et al.*, 1999). Contrarily, CI focuses on the coalition of many different criteria, which offers additional insights, informative results and transparency. Moreover, VRIO faces an ultimatum regarding quantitative approaches, which led various authors to employ unsatisfactory, outdated options (*e.g.*, case studies and outlier samples). The modern approach of CI considers the use of quantitative and qualitative criteria and is able to resolve complex decision problems (Demirel *et al.*, 2010; Estêvão *et al.*, 2019). The elucidation of aggregation offers a further comprehension to the "how" and "why" located in decisions, which in the case of "why" resolves quantitative questions and aids to grasp the influence regarding decision-makers' satisfactions (Büyüközkan *et al.*, 2009). Communication is, therefore, essential to conclude the decision-making process and deliver rational outcomes.

Adjacent to the previous point, Mahdi *et al.* (2019) state that, whenever communication is not prioritized, resources will not be able to meet the four pillars of the VRIO framework. CI, however, is based on the communication that occurs with decision makers in the first phase of the decision process, and encourages the sharing of information,

the importance of certain criteria or commentaries about the interaction of criteria (Angilella *et al.*, 2004). The next chapter will focus on the combination of CI and the VRIO framework to produce a quantified-VRIO and enhance the evaluation process of resources and capabilities.

SYNOPSIS OF CHAPTER 2

This second chapter aimed to further understand multiple criteria decision analysis (MCDA) and how a stable structure for complex decisions and comprehension of multiple criteria leads to well-informed decisions (Belton and Stewart, 2002). MCDA is based on three fundamental convictions: (1) *learning through participation*; (2) *constructivism*; and (3) *the inseparability of objective and subjective aspects in the decision making process*. MCDA has three key phases: structuring; evaluation; and recommendations, which occur during the decision-making process and are strongly influenced by the chosen decision makers, who typically are experts in their fields. MCDA can be a helpful tool for the VRIO framework, since its three basic convictions could offer a well-informed approach with the participation of decision makers, which tends to be lacking when applying VRIO. Furthermore, MCDA presents a framework that is able to deal with complex decision situations and support information sharing among stakeholders. MCDA also offers a ranking system, with preferred options and clearer vision about acceptable possibilities. Additionally, problems are organized, criteria are ranked accordingly with their relative importance and preference, and evaluations are joined to offer final decisions. Furthermore, MCDA is able to avoid the gaps that can occur when analyzing qualitative and quantitative criteria. The second part of this chapter focuses on the Choquet integral (CI), and its ability to aggregate partial scores taking into account criteria coalition. CI is focused on two fundamental conditions, namely: (1) utility values are on a common interval scale of criteria performances; and (2) a ratio scale is used for numerical value $\mu(T)$ to each subset (T). The method requires decision criteria to be evaluated on a common scale, and that they should be ranked from smallest to largest to calculate differences of utilities regarding different dimensions. Throughout, CI considers the elucidation of aggregation as crucial, as it helps to comprehend the "why" in the decision-making process, which delivers a quantitative response and acknowledges the satisfaction of distinct criteria. It is able to manage interrelationships and interconnected criteria, where VRIO considers a resource as a single entity. Therefore, CI can offer further insights, enlightening results and transparency during the decision-making process. It sees communication as a key factor to achieve satisfying results, which is why decision makers are encouraged to share information or to comment on subjective importance of decision criteria or the understanding of the interaction occurring in certain criteria. The next chapter will focus on the application of CI to enhance the VRIO framework.

PART II

EMPIRICAL APPLICATION

CHAPTER 3

APPLICATION AND RESULTS

The combination of RBV and MCDA is innovative and produces a framework able of quantifying VRIO results and enhancing strategic management. In this chapter, Coliving Factory (CF) provides insights on its resources and capabilities, while the company's critical factors of success are obtained using a VRIO matrix. This chapter will thus focus on: (1) the framework's background and application; (2) the analysis of results; and (3) the consolidation and formulation of recommendations according to the final outcomes.

3.1. Framework and Application

RBV represents a framework that focuses on the effective use, bundling and exploiting of internal resources to achieve sustainable competitive advantage. Two decisive categories of resources are identified: tangible and intangible. Those categories can be subdivided in four types: (1) physical assets; (2) financial resources; (3) human capital; and (4) organizational culture (Tran *et al.*, 2020). Physical assets can be categorized as equipment, buildings, vessels and trucks. They may offer various benefits in terms of economic, social and environmental improvements. Financial resources focus on capital and financial instruments, and organizations should assure the possession of capital from shareholders or enough earned profits for reinvestments. Human capital is defined as a dynamic capability that assures the merging of an organization's strategies and business methods, so as to keep its competitive advantage. Education, training and gained experience lead to a certain level of knowledge, which can further on be applied in group or board meetings. Organizational culture can be understood as a mixture of values and expectations that determine the goals and success of an organization. An anchored culture, which is strongly supported by employees, can significantly increase the chances of success, improved missions and objectives (Tran *et al.*, 2020).

VRIO can be used as an aid to evaluate resources and competencies, so as to further understand if resources and capabilities can achieve sustainable advantage. Furthermore, if

resources are valuable, rareness, inimitable and organized, sustained competitive advantage is achieved. Additionally, CFS can also be applied to further understand how specific strategies and objectives, chosen by an organization, which are complex to implement or copy for rivals, led to competitive advantage.

MCDA is a framework that enables understanding of complex decision situations and favorizes information sharing between stakeholders. MCDA proposes a ranking system to distinguish acceptable from unacceptable possibilities. Criteria are ranked corresponding to their importance and evaluations are combined to present appealing final decisions. MCDA is focused on avoiding gaps, which can appear when analyzing qualitative and quantitative decision criteria. In this context, CI is an information aggregator that takes into account criteria coalition. CI concentrates on two fundamental conditions: (1) utility values are based on a common interval scale of criteria performances; and (2) a ratio scale is adopted for numerical value $\mu(T)$ according to each subset (T). CI implies that decision criteria should be assessed on a common scale and ranked from smallest to largest to calculate differences of utilities. To assure the enhancement of strategic management and obtain a quantified VRIO, *Figure 7* offers a conceptual diagram delineating the methodological procedures followed in this study.

Figure 7: Methodological Procedures Followed

The chosen company, Coliving Factory (hereafter "CF") is a real estate manager and developer that specializes in an innovative way of cohabiting. CF was created in 2017 by Guillaume Robert-Legrand. The headquarters are located in Nantes, France. The information gathering was conducted with the help of a co-founder and shareholder, Joël Murcia (hereafter "decision maker"). To gain further understanding of the company, six steps where undertaken; namely (1) list of resources and capabilities; (2) identification of a resource categorization system; (3) categorization of the company's resources and capabilities; (4)

checking of the VRIO postulates of applicability; (5) VRIO application; and (6) identification of CFS.

Step 1: List of Resources and Capabilities

According to the decision maker, the most essential aspect regarding resources and capabilities is represented by the CF's employees. Candidates who are hired have strong background and experience in the real estate sector and are up-to-date on the most recent technological novelties. Nevertheless, CF does not favorize the hiring of juniors, as experience plays a crucial factor in CF's activity. This can be "tricky" because young adults have little or no experience in the desired field. Regarding the immaterial aspect, by offering a cohabitation solution in residences filled with less than 20 homes, CF focuses on adopting a different strategy than regular renting companies in France. Their offer stands out due to the number of services offered, namely: access to Netflix; electric cars; and delivery of bread and fresh vegetables, as well as the economic benefit to rent a studio in case of absence (*e.g.*, winter/summer break). Regarding tangible materials, the decision maker discloses how CF is mainly working on the renovation of obsolete buildings, which will then be transformed into residences. The challenge occurs during the purchase of older buildings, preferably located in attractive areas, with a surface ranking from 500 to 900 m^2. Furthermore, CF offers a variety of advantageous intangible resources. Nine services charges are covered and offered when moving into one of the residences, namely: car-sharing with access to one or more electric cars; access to an electric scooter; possibility of renting a studio in case of absence; an additional guest room; no additional fees when moving in; a designated person to assure the well-being of the renter; cleaning-service; Netflix; WIFI; game consoles; and, finally, a free laundry room. Furthermore, CF has four partnerships: Renault; Samsung; Habitat; and Duvivier. Renault offers its support with access to Zoey electric cars. Smart appliances are supplied by Samsung and installed inside the residences (*e.g.*, fridges connecting to mobile phones). Duvivier offers bedding, mattresses, box springs and accessories created in France. Habitat furnishes the CF residences, which allows for tasteful and comfortable homes. *Figures 8* presents a visiual aid regarding the current state of the co-residences, while *Figure 9* is a list of the current employees and their accumulated salaries. *Table 1* presents the essential resources and capabilities of CF.

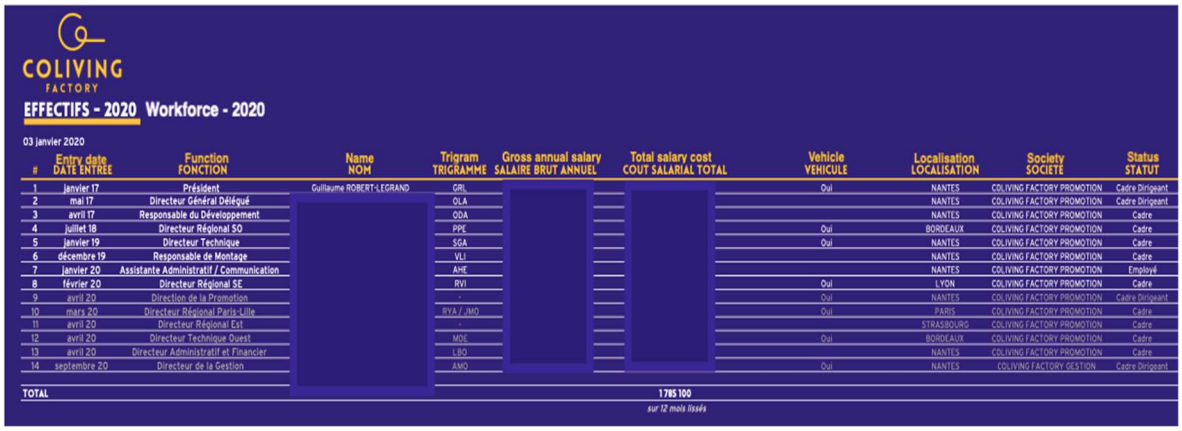
COLIVING FACTORY

CORESIDENCES EN COURS

25 novembre 2019

Co-residences under management CORESIDENCES SOUS GESTION	City VILLE	Name NOM	Partners PARTENAIRE	Lots LOTS	NB CORESIDENCES	Status STATUT	Probability PROBABILITE	Opening date DATE D'OUVERTURE	Block sale price (En Euros H.T.) PRIX DE VENTE EN BLOC
-	NANTES			4	1	RENOVATION	100	mai 2018	340 000
TOTAL				**4**	**1**				**340 000**
Co-residences controlled (acquired) **CORESIDENCES CONTROLEES (ACQUISES)**									
1	BORDEAUX			11	1	RENOVATION	100	décembre 2019	
2	NANTES			13	1	RENOVATION	100	novembre 2019	
3	NANTES			19	1	RENOVATION	100	septembre 2020	
TOTAL				**43**	**3**				**5 640 000**
Co-residences secured (under compromised and urban authorization) **CORESIDENCES SECURISEES (SOUS COMPROMIS ET AUTORISATIONS D'URBANISME)**									
4	BORDEAUX			14	2	RENOVATION	100	septembre 2020	
5	BORDEAUX-PESSAC			15	1	RENOVATION	100	décembre 2020	
6	BORDEAUX			11	1	RENOVATION	100	décembre 2020	
7	NANTES			16	1	RENOVATION	100	décembre 2020	
8	REZE			11	1	RENOVATION	100	février 2021	
9	LA ROCHE/YON		VINCI	40	3	NEUF	100	juillet 2022	
10	SAINT-MALO		BOUYGUES	45	2	NEUF	100	juillet 2022	
11	NANTES		ARC	20	2	NEUF	100	octobre 2021	
TOTAL				**172**	**13**				**25 250 000**
Co-residences under offer **CORESIDENCES SOUS OFFRE**									
12	BLOIS		VINCI	40	3	NEUF	85	juillet 2022	
13	TOURS		SOGEPROM	45	3	NEUF	85	décembre 2022	
14	RENNES		LINKCITY	45	4	NEUF	80	avril 2022	
15	BREST		STEVA	30	2	NEUF	90	septembre 2021	
16	BORDEAUX-TALENCE			18	2	RENOVATION	90	juillet 2021	
17	BORDEAUX			9	1	RENOVATION	80	septembre 2020	
TOTAL				**187**	**15**				**27 475 000**
Co-residences under study **CORESIDENCES A L'ETUDE**									
18	ANGERS			20	2	NEUF	85	septembre 2021	
19	ANNECY			52	3	NEUF	80	septembre 2021	
20	NANTES			32	2	NEUF	75	septembre 2021	
21	NANTES			14	1	RENOVATION	75	septembre 2021	
22	NANTES			27	2	RENOVATION	75	septembre 2021	
23	SAINT-NAZAIRE			16	1	NEUF	75	septembre 2021	
24	PARIS			18	1	RENOVATION	75	septembre 2021	
25	NANTES			30	2	NEUF	75	mars 2022	
26	BORDEAUX			12	1	RENOVATION	70	décembre 2020	
27	SAINT HERBLAIN			25	2	NEUF	65	septembre 2021	
28	SAINT MALO			24	3	RENOVATION	65	septembre 2021	
29	LE MANS			45	3	NEUF	65	décembre 2023	
30	NANTES			25	2	NEUF	65	décembre 2023	
31	PARIS			50	3	NEUF	60	juillet 2022	
32	TOULOUSE			40	3	NEUF	60	septembre 2021	
33	NANTES			15	1	RENOVATION	60	octobre 2020	
34	FONTENAY-LE-COMTE			20	2	RENOVATION	50	septembre 2021	
35	BORDEAUX			13	1	RENOVATION	50	septembre 2021	
36	BORDEAUX			12	1	RENOVATION	50	septembre 2021	
37	CHATEAUBRIANT			16	1	NEUF	50	septembre 2021	
38	PARIS			4	1	RENOVATION	50	septembre 2021	
39	NANTES			28	4	NEUF	40	juillet 2022	
40	ANGERS - AVRILLE			45	3	NEUF	40	juillet 2022	
41	ANGERS			45	3	NEUF	40	juillet 2023	
42	TOURS			16	1	NEUF	35	septembre 2021	
43	NANTES			24	2	RENOVATION	35	septembre 2021	
44	NANTES-REZE			25	2	NEUF	30	décembre 2022	
45	BORDEAUX-PESSAC			12	1	RENOVATION	30	juillet 2021	
46	SCHILTIGHEIM			40	3	NEUF	25	septembre 2021	
47	NANTES			25	2	NEUF	25	juin 2021	
48	VANNES			15	1	NEUF	25	juillet 2022	
49	NANTES			20	1	NEUF	25	juillet 2022	
50	LORIENT			15	1	NEUF	25	décembre 2022	
51	ST ETIENNE (VILLARS)			36	2	NEUF	25	avril 2021	
52	STRASBOURG			20	2	RENOVATION	25	avril 2022	
53	NANTES			14	1	NEUF	25	avril 2022	
54	TOURS			15	1	RENOVATION	20	septembre 2021	
55	LA BAULE			20	1	RENOVATION	20	avril 2022	
56	NANTES			16	1	RENOVATION	15	septembre 2021	
57	NANTES			15	1	NEUF	15	septembre 2021	
58	LAVAL			55	3	RENOVATION	15	avril 2022	
59	LUCON			25	1	NEUF	10	avril 2022	
60	TOURS			45	3	NEUF	5	décembre 2023	
61	TOURS			45	3	NEUF	5	décembre 2023	
TOTAL				**1 125**	**81**				
TOTAL				**1 527**	**112**				**215 634 000**

Figure 8: Co-Residences in Progress



COLIVING FACTORY

EFFECTIFS - 2020 Workforce - 2020

03 janvier 2020

#	Entry date DATE ENTREE	Function FONCTION	Name NOM	Trigram TRIGRAMME	Gross annual salary SALAIRE BRUT ANNUEL	Total salary cost COUT SALARIAL TOTAL	Vehicle VEHICULE	Localisation LOCALISATION	Society SOCIETE	Status STATUT
1	janvier 17	Président	Guillaume ROBERT-LEGRAND	GRL			Oui	NANTES	COLIVING FACTORY PROMOTION	Cadre Dirigeant
2	mai 17	Directeur Général Délégué		OLA				NANTES	COLIVING FACTORY PROMOTION	Cadre Dirigeant
3	avril 17	Responsable du Développement		ODA				NANTES	COLIVING FACTORY PROMOTION	Cadre
4	juillet 18	Directeur Régional SO		PPE			Oui	BORDEAUX	COLIVING FACTORY PROMOTION	Cadre
5	janvier 19	Directeur Technique		SGA			Oui	NANTES	COLIVING FACTORY PROMOTION	Cadre
6	décembre 19	Responsable de Montage		VLI				NANTES	COLIVING FACTORY PROMOTION	Cadre
7	janvier 20	Assistante Administratif / Communication		AHE				NANTES	COLIVING FACTORY PROMOTION	Employé
8	février 20	Directeur Régional SE		RVI			Oui	LYON	COLIVING FACTORY PROMOTION	Cadre
9	avril 20	Direction de la Promotion		-			Oui	NANTES	COLIVING FACTORY PROMOTION	Cadre Dirigeant
10	mars 20	Directeur Régional Paris-Lille		RYA / JMO			Oui	PARIS	COLIVING FACTORY PROMOTION	Cadre
11	avril 20	Directeur Régional Est		-				STRASBOURG	COLIVING FACTORY PROMOTION	Cadre
12	avril 20	Directeur Technique Ouest		MDE			Oui	BORDEAUX	COLIVING FACTORY PROMOTION	Cadre
13	avril 20	Directeur Administratif et Financier		LBO				NANTES	COLIVING FACTORY PROMOTION	Cadre
14	septembre 20	Directeur de la Gestion		AMO			Oui	NANTES	COLIVING FACTORY GESTION	Cadre Dirigeant
TOTAL						1785 100				
						sur 12 mois lissés				

Figure 9: CF's Workforce in 2020

CF resources and capabilities
7-14 employees; Mature team 40-55; Experience in real estate; Fight against solitude.
TSC: 1785100 euros; Final sale price: 215634000 euros; Lots: 1527 (January 2020).
Co-residences finished or in progress; Opening date from 2018-2023; Positive prospect for 2020-2027 regarding lots, promotion/turnover and net profit.
Growth of company; Opportunity of various job positions (January 2020); Strength of holding in Luxembourg

Table 1: CF List of Resources and Capabilities

Step 2: Identification of a Resource Categorization System

The decision maker identified the following resource categorization clusters: (1) human capital; (2) finance; (3) physical assets; and (4) organization. CF currently has 7-14 employees, which should increase in 2020. The age ranks from 40 to 55, which makes CF a more mature organization and internships are momentarily not encouraged. CF hires external enterprises to cover issues of law and accounting, as well as fiscal procedures. CF has three representatives in its holding in Luxembourg, which holds the entire society in France. CF has eight employees in France, a number which is expected to double in the two coming years. The holding and the company have access to a shared iCloud account and Dropbox. Regarding finance, CF issued a bond issue of 10 million euros to finance its development. The decision maker explained that the most vital assets of the organization are the offices in Nantes and Luxembourg, the purchases of the CF residences and the current development project that ranks to 1100 lots. The physical aspect, as mentioned before, focuses on the

renovation of building into residences. Furthermore, the organization is well-balanced due to its holding in Luxembourg, which finances the operational development of the French branch, and provides monthly dashboards that lay out the control of expenses and revenues of the companies involved. In France, each CF project is analyzed by a project editor, who encrypts the project and controls the possible profitability. Furthermore, the project is analyzed by the French team and, according to their agreement, the Luxembourgish holding is contacted, which must additionally validate the purchase. For each purchase made by CF, the company pays a certain amount and the rest is supplemented by mutual credit. The French government has launched an action plan to boost 222 cities in France. CF aims to optimize and purchase real estate assets in those cities and renovate them accordingly. The residences are designed to welcome and attract mostly young adults in search of housing. CF projects are, therefore, well seen in town halls and by the ministry of housing in France. They are currently in discussion to launch a collaboration with governmental funding. CF tries to adapt its price ranges according to the salaries earned and financial situation in the town of interest. Nantes, for example, has low rents ranging from 450-550 euros, making CF an ideal solution for students with lower budgets, who are therefore no longer forced to leave their communities. One of the greatest concerns in France is the fight against isolation and loneliness, which is why CF offers privacy while also encouraging interaction between renters, if needed. CF was also inspired by the concept of cohabitation, due to the increase of citizens who faced devastating situations in their lives, which lead to positions of social distress as they are no longer able to find and afford housing.

Step 3: Categorization of the CF's Resources and Capabilities

As for the categorization of the CF's resources and capabilities, four categories are considered: human capital, finance, physical assets and organization. Considering human capital, CF currently works alongside a team of 7-14 people, and the hiring process relies on the experience collected in the real estate sector. CF thus has a more mature team and does not consider trainees, as yearly accumulated knowledge is crucial in this specific sector. The current workforce (January 2020) is concocted as listed: the president Guillaume Robert-Legrand; a deputy managing director; a development manager; various regional directors; a technical director; an assembly manager; an administrative/communication assistant; a promotion director; a regional director for Paris-Lille; an eastern regional director; a western technical director; an administrative/financial director; and a management director. The

listed employees are dispatched in different regions of France, Nantes, Bordeaux, Lyon, Paris and Strasbourg, and can therefore suggest co-residences in various regions across the country. Furthermore, CF is an advocate of fighting against solitude, while offering private rooms and bathrooms.

With regard to finance, CF firstly ensured its development by delivering a bond issue of 10 million euros. The success of the co-residences amongst young actives not only allowed for the hiring of new employees but, in regard to the organization, the total salary cost of current employees in January 2020 accumulated 1.785.100 euros. Considering the 112 CF co-residences that are either acquired or under management, the block sale prices rise up to 215.634.000 euros. The lots required for forthcoming projects have been extended to 1527.

CF most appealing physical asset is their co-residences, which can be under management, controlled, under compromise/urban authorization or under offer/study. Their various co-residences are spread over multiple French regions, and are momentarily either being renovated or consist of recently modernized residences. The success of these co-residences and their inspiring final sale price can be explained by their appeal to young workers, who are in need of homes at reasonable prices. The current opening dates of the co-residences span from 2018 to 2023. Furthermore, according to prospect for 2020 to 2027, the number of lots, the promotion and the turnover, as well as the net profit, are all forecasted to rise and, thereby, assure favorable outcome for CF.

The organization of CF, according to its organizational chart from January 2020, delivers insight on the growth of the company over recent years. 7-14 people are currently employees, with a wide opening of job positions in their agencies across French regions or within the management team. The position marked as "?" is currently pending or being finalized. Furthermore, CF works with its holding in Luxembourg to ensure appropriate funding for operational development of imminent projects. Additionally, CF is working on extending the concept of co-residences in different European countries. *Table 2* presents the allocation of CF's resources and capabilities according to the four categories identified in *step 2*.

CATEGORIES	CF resources and capabilities
Human Capital	7-14 employees; mature team 40-55; experience in real estate; fight against solitude.
Finance	TSC: 1.785.100 euros; final sale price: 215.634.000 euros; lots: 1527 (January 2020).
Physical Assets	Co-residences finished or in progress; opening date from 2018-2023; positive prospect for 2020-2027 regarding lots, promotion/turnover and net profit.
Organization	Growth of company; opportunity of various job positions (January 2020); strength of holding in Luxembourg; extend the concept outside of France.

Table 2: Categories and List of Resources and Capabilities

Step 4: VRIO Postulates of Applicability

Regarding the VRIO postulates of applicability, the decision maker expressed the following analysis. In terms of tangibility, CF relies on the credibility of its most relevant physical assets (*i.e.*, the co-residences and their constant renovation or modernization process of acquired buildings). Multiple co-residences are currently in phases of improvement or being restored to meet the needs of potential clients, while assuring a lower price in a demanding sector. The residences encourage privacy while also offering the option of shared common spaces to avoid solitude, as can be seen in *Figure 10*. Another tangible advantage is the option to obtain a work vehicle if needed.

Figure 10: Example of CF Residence

Following this, CF strongly relies upon their intangible resources, particularly regarding their employees and management. While CF is not the largest company in the market, the achievements of recent years have fueled the company's team growth of mature and experienced employees in the real estate sector. The dispatchment of the team in different areas in France has led to the convenience of opening residences in diverse towns. Further on, the organization chart conducted in January 2020 expects the arrival of a large number of new members. Consequently, the prospect for the seven following years gives a clearer vision about how future objectives should be achieved.

CF guarantees the immobility of its resources and capabilities by offering services that differ from their direct competitors in the market. CF grants the following options to tenants of co-residences: (1) access to Zoey electric cars and scooters; (2) accessibility to rent an accommodation when absent; (3) a guest room; (4) no fees when relocating; (5) a designated representative; and (6) a cleaning service/laundry room. Furthermore, CF offers entertainment services by providing video game consoles, Netflix and WIFI for all its residences. Correspondingly, CF tries to stand out by furnishing the entire house décor from Habitat and uses smart devices by Samsung that allow constant accessibility via phones. Furthermore, the French bedding company Duvivier provides mattresses with air-system and further sleeping accessories. *Figure 11* presents some of the CF partnerships.

Figure 11: CF Partnerships

CF distinguishes itself in terms of heterogeneity by combing its multiple tangible and intangible resources and capabilities, which allow the company to differ from competitors in the real estate sector. CF provides a variety of co-residences in multiple cities in France at fair prices for young people unable to survive on a single salary. By choosing CF, various needs are met regarding either tangible or intangible capabilities. Tenants have access to vacant vehicles/scooters and a residence that focuses on allowing independent spaces as well as common areas, which facilitates the social balance of young adults. The ease of moving into a fully furnished accommodation eradicates most of the more stressful tasks associated to the renting of a regular apartment. Due to the four partnerships in *Figure 11*, renters can

benefit from high-quality living at a low renting price. The advantage of their intangible resources is manifested by choosing people with a certain knowledge and experience in the sector, who can, therefore, support and advice renters with an undeniable ability.

Step 5: VRIO Matrix

VRIO stands for valuable, rare, inimitable and organized. The following VRIO matrix gives a visual aid to further understand how the four pillars can be applied to resources and capabilities and, further on, lead to sustained competitive advantage. To achieve competitive advantage, the four following questions should be answered positively: (1) Is the resource/capability valuable?; (2) Is it rare?; (3) Is it difficult to imitate?; and (4) Is the company organized to take advantage of the resource/capability in question? *Table 3* demonstrates the application of the VRIO matrix to CF's resources and capabilities.

CATEGORIES	CF resources and capabilities	V	R	I	O	Type of competitive advantage
Human capital	7-14 employees; Mature team 40-55; Experience in real estate; Fight against solitude.	YES	YES	NO	-	Temporary
Finance	TSC: 1785100 euros; Final sale price: 215634000 euros; Lots: 1527 (January 2020).	YES	YES	YES	YES	Sustainable
Physical asset	Co-residences finished or in progress; Opening date from 2018-2023; Positive prospect for 2020-2027 regarding lots, promotion/turnover and net profit.	YES	YES	NO	-	Temporary
Organization	Growth of company; Opportunity of various job positions (January 2020); Strength of holding in Luxembourg; Extend the concept outside of France.	YES	YES	YES	YES	Sustainable

Table 3: VRIO Matrix on CF's Resources and Capabilities

Human capital resources and capabilities are mostly formed by the workforce of CF, which is currently altering and should significantly increase in the coming months. The characteristics are clear: the employee should have surpassed the rank of junior and be experienced in real estate. Considering the VRIO matrix, those resources and capabilities can be seen as valuable and rare. However, it would not be difficult for a competitor to copy

the strategy of hiring a more mature audience, which is therefore not classified as a VRIO resource.

Finance, when merged with the VRIO matrix, provides an attractive solution to obtain sustained competitive advantage. Considering that CF has been created in 2017, their total salary cost for a still blooming company can be considered impressive. In January 2020, the total salary cost represented 1.785.100 euros. CF is currently owner of 112 acquired co-residences or under management, with a final sale of 215.634.000 euros. The 1100 lots that were previously determined for upcoming projects have been enhanced to 1527. Consequently, these numbers demonstrate that the finance of CF is valuable, rare, hard to imitate and earnestly organized.

Regarding the physical assets of CF, the renovation or renewing of the co-residences across France should be terminated and open to renting from 2018-2023, with confident prospect for the next seven years. The co-residences and the benefits that it provides, in terms of driving, cleaning and entertainment services, is unique and, therefore, valuable and rare. However, those uncommon services could easily be imitated by competitors and create direct rivals.

Finally, the organizational aspect of CF demarks itself as an interesting asset for sustained competitive advantage, as the management team desires to extend the concept outside of France and tries to fight for humanitarian causes. The concept is valuable, rare, difficult to imitate and organized. CF cares about offering homes at a fair price, calculated according to salaries and financial situations of specific regions. To avoid loneliness, CF gives an opportunity to connect with other tenants in common areas. Social distress should be avoided at all cost, which is why their model was based on affordable prices.

After explanation of the VRIO matrix applied to CF's resources and capabilities, the decision maker mentioned that the value of CF can be described as followed: a good is purchased, renovated and offered for sale as an innovative CF residence. This residence will be sold to an institution or real estate company, but CF keeps the management of each one of the housing complexes. Currently, the name "Co-residence" has been laid down as a patent. In terms of financial value, it is believed that each lot will generate 1.200 euros. The medium- term goal would be to acquire 10.000 lots in the seven next years. As a company's value is determined by 12 times its revenue, the decision maker proposed the following calculation: 10.000 x 1200 x 12 = 144.000.000 euros.

Rareness can be demonstrated as CF is aware that other cohabitation residences have been constructed, but with a tendency to focus on larger lots, that can go up to 200. CF is

interested in smaller residences, with 10 to 20 lots. Even though the demand is constantly increasing, the focus of the organization is to offer small yet highly private and equipped living arrangements. The decision maker explained that the difference between Airbnb and CF lies in the possibility for the renter to have a lease with the person's name, which is often required for administrative processes and a personal address. Inimitability is more complex, as cohabitation concepts are easy to copy, and various co-living situations exist nowadays, but mostly in larger residences. However, due to an increase in students and young adults with salaries, who are unable of covering high rents, the CF offers find a taker. Compared to other housings, CF has a certain attractiveness which can't be denied, considering the smart and innovative residences, filled with enjoyable services. The organizational aspect of CF calls for improvement, as the company is still young. The current challenge lies in finding qualified and motivated human resources that will allow to continue the development in France and Europe. The organization of CF starts with the Luxembourgish holding company and has an endless source of help, due to the external companies working on internal and external legal and fiscal procedures.

Step 6: Identification of CFS

Regarding CFS, only the resources and capabilities that meet the four pillars of the VRIO matrix can be considered CFS. Both the finance of CF and the results obtained over two years prove the efficiency of their management and that the offer meets the need of a group of young professionals on a budget. Complementarily, CF could have failed, as direct competitors, with similar service offers already have generated strong communities and loyal customers. By standing out, CF was able to succeed in a challenging sector.

Additionally, the organization can be demonstrated as a CFS, as a rather dispersed group of employees was able to grow its organization, offer a variety of recently added job positions, work closely with its holding in Luxembourg and work toward targeting other European countries. According to the decision maker, the work concept of CF is difficult to imitate as they differentiate themselves with distinct features and services, such as: the vehicle offer; centrally located co-residences; projects of acquiring agriculture fields for the plantation of fruits and vegetables, which will be put in baskets at a final value of 40 euros; weekly deliveries of fresh bread; and the opportunity to receive smart devices from Samsung for the residences. Technically, causal ambiguity is present in CF's portfolio of resources

and capabilities. CF wants to emerge very humane and focused on shared living. The following topic will introduce the application of CI and focus on its analysis and results.

3.2. CI Application

For the performance analysis of CF and two of its competitors, the application of CI was introduced. As discussed earlier, CI focuses on the following fundamental conditions: (1) utility values are introduced on a common interval scale of criteria performances; and (2) a ratio scale is used for numerical value $\mu(T)$ on each subset (T). CI requires decision criteria to be based on a common scale and ranked from smallest to biggest, as a way to calculate differences of utilities. *Table 4* demonstrates the 10-point scale on which the decision maker scored CF's resources and capabilities.

SCALE	DESCRIPTION
0	Totally Undesirable Situation
1	⇩
2	⇩
3	⇩
4	⇩
5	Common Situation
6	⇩
7	⇩
8	⇩
9	⇩
10	Totally Undesirable Situation

Table 4: CI 10-Point Scale

According to the 10-point scale presented in *Table 4*, the decision maker was asked to score all possible combinations for the four categories of resources and capabilities previously identified, namely: human capital; finance; physical assets; and organization. *Table 5* presents the different possible combinations, and the score provided by the decision maker to each combination analyzed.

Human Capital	Finance	Physical Assets	Organization	Evaluation
Bad	Bad	Bad	Bad	**0**
Good	Bad	Bad	Bad	**3**
Bad	Good	Bad	Bad	**3**
Bad	Bad	Good	Bad	**2**
Bad	Bad	Bad	Good	**2**
Good	Good	Bad	Bad	**4**
Good	Bad	Good	Bad	**4**
Good	Bad	Bad	Good	**5**
Bad	Good	Good	Bad	**4**
Bad	Good	Bad	Good	**4**
Bad	Bad	Good	Good	**3**
Good	Good	Good	Bad	**6**
Good	Good	Bad	Good	**7**
Good	Bad	Good	Good	**6**
Bad	Good	Good	Good	**7**
Good	Good	Good	Good	**10**

Table 5: Scores Obtained for the Different Combinations of Categories

The decision maker was then asked to answer questions, such as: "How do you classify a situation where human resources are *Good*, but all the other resources and capabilities are *Bad*?". In this specific example, the decision expert scored the *Good – Bad – Bad – Bad* combination (line 2 in *Table 5*) with 3 points. Next, using the same 10-point scale, the decision maker was asked to score CF and two of its competitors' (*i.e.*, The Babel Community and La Casa) categories of resources and capabilities. *Table 5* shows the scores provided by the decision maker.

	CF	The Babel Community	La Casa
Human Capital	8	8	6
Finance	5	5	5
Physical Assets	8	7	7
Organization	7	7	7

Table 6: CF and Competitors' Performances

In terms of human capital, CF was ranked with an 8, as the decision maker believes that its more mature and experienced-employee basis represents its strongest asset and should increase in the coming months. CF distinguishes itself from its competitors by offering a team that prides itself on offering high knowledge on the real estate business. Even though CF provides astonishing results for a young company regarding TSC and combined salaries, the decision maker ranks finance in January 2020 at a 5, as CF is currently in the process of acquiring eight residences and should receive a profit of 25 million euros in a succeeding period. Furthermore, CF offers unprecedented residences that propose attractive services at a reasonable price. Both the materialist and emotional needs of the clients are met, as the they can decide to seclude themselves or use the shared rooms for interactions. The decision maker, therefore, scored CF's physical assets at 8. Correspondingly, in terms of organization, CF will increase the team at the beginning of 2020 and is momentarily in the process of hiring new employees in various regions of France.

The main competitors of CF are The Babel Community (TBC) and La Casa (LC). Their co-living residences focus on individual and shared rooms, the necessary furniture for quick relocation and administrative facilities, similar to the offer of CF. Nonetheless, the differences occur in the services included as regard to the provided furniture and equipment. CF offers various services as its laundry room, entertainment utensils and vehicles. It is worth noting, however, that those services can be considered optional for some co-residences. In general, co-residences in terms of intangible services tend to facilitate rent contracts, Internet subscription and administrative management. Furthermore, some operators may opt to propose a digital platform as Netflix, a concierge service or a delivery system. The target audience for the concept of co-living can be ranked into three categories: students, young actives and seniors. CF chooses to target young workers that struggle to

afford expensive rents. TBC operates large residences mostly in the South of France, while LC offers medium sized residences in the surroundings of Paris. TBC has been ranked highly by the decision maker. TBC offers for example in its shared rooms, the opportunity to use it as a coworking space, which allows renters to work completely or part-time from home. Furthermore, TBC has a strong communication approach and has been interviewed by French media (TF1, Les Echos and Le Figaro), which influenced the equal scoring of CF. Regarding finance, it has also been identically ranked as CF. The decision maker believes that their physical assets deserve to be ranked at 7, as they have an interesting selection of residences and grant access to a cafeteria and a sport gym. Furthermore, the organization was ranked equally to CF.

LC shows a lot of potential but works in smaller residences, while still offering outstanding services, in terms of equipment, cleaning services, secured door system and a monthly food delivery system. Furthermore, LC has attracted various French TV channels and journals. The decision maker ranks their human capital performance at 6, as LC shows tremendous potential for the future. Finance was scored correspondingly to its two competitors. LC proposes solely houses, that are either immediately accessible or give access to a waiting list. LC attempts to attract different types of renters, with houses that have explicit themes; for instance, the Sports House that focuses on fitness activities, the Chef House for food enthusiasts, the Wellness House with access to sauna, the Green House for environmentally conscious renters and the Movie House that proposes an unlimited UGC card. The decision maker ranks the physical asset of LC at 7. In terms of organization, LC deserves an identical score to that of both rivals, due to its creativity and segmentation idea. According to *Table 5*, CF ranks human capital alone (*i.e.*, *Good – Bad – Bad – Bad*) at 3 points. Finance (*i.e.*, *Bad – Good – Bad – Bad*) scored 3 as well. It could be expected that both categories combined (*i.e.*, *Good – Good – Bad – Bad*) would score 6. The decision maker, however, ranks human capital and finance at 4, which is lower than the expected outcome. The same results can be observed with physical assets and organization, which were, individually (*i.e.*, one *Good*), scored at 2 points, but when combining physical assets and organization, the score was ranked at 3 points, which is below the expected 4.

The decision maker tends to attribute lower scores when faced with only one rewarding category (*i.e.*, *Good – Bad – Bad – Bad*) and does not attribute the expected scores when two categories are ranked as *Good*. Nonetheless, it can be observed that the highest combination of two categories – human capital and organization – was ranked at 5, which represents the highest combination of two categories. The decision maker explained that the

determination and knowledge of its employees has to be aligned if CF wants to achieve various objectives. By having a common vision and understanding of the desired outcomes, CF has a higher chance to success. Additionally, the decision maker ranked the combination of human capital and physical assets; finance and physical assets; and finance and organization at an equal score of 4. None of these combinations match their expected outcomes and have all been ranked lower than anticipated.

Furthermore, when analyzing the combination of three categories (*i.e.*, *Good – Good – Good – Bad*), the pattern repeats itself, as none of the scores represent the expected outcomes. Human capital combined with finance and physical assets (*i.e.*, *Good – Good – Good – Bad*) should have achieved a score of 8 and received 6 points, which is the same score suggested for human capital, physical assets and organization (*i.e.*, *Good – Bad – Good – Good*). Additionally, the highest combination of three categories: human capital, finance and organization, and finance, physical assets and organization were both ranked at 7 points.

Considering the scores attributed by the decision maker, it can be observed that no combination was ranked higher than 7 and no combinations were scored as expected, which demonstrates that the lack of performance of one category can decrease all other resources and capabilities. The ranking was done in a harsh manner to demonstrate that one category scored as *Bad* outranks three categories scored as *Good*. The decision maker considers that all of the categories listed in *Table 5* have to be ranked as *Good*, if sustainable competitive advantage is to be achieved. *Table 6* also shows that CF's finance is awarded a 5, which represents the lowest score, compared to both 8 for human capital/physical assets and organization at 7. The decision maker is optimistic and believes that, as soon as their desired transaction for 8 residences (*i.e.*, 25 million €) comes through, this score will be able to increase. TBC and LC both ranked their finance equally to CF at 5. The decision maker chose an identical score as, from a personal and professional point of view, both competitors are not superior to CF in terms of finance. To improve their finances, the most logical option for competitors would be to follow the traced path of co-living, which is to acquire residences and meet suitable renters' needs. Furthermore, the three companies have all been ranked at 7, as the decision maker sees a lot of similarities in the way the companies are being operated. LC, however, is a promising company with interesting segmentation ideas but should improve its human capital, as it was ranked the lowest of the three companies with a 6.

To gain further in depth about the scores given by the decision maker, CI was used as it facilitates the calculation of criteria coalition. Firstly, CI considers that criteria should

be estimated on a common scale and ranked from smallest to largest, so as to determine variation of utilities. *Table 7* displays the order obtained for CF and the competitors.

	CF
Human Capital (HC)	8
Physical Assets (PHA)	8
Organizational (ORG)	7
Finance (FIN)	5

	TBC
Human Capital (HC)	8
Physical Assets (PHA)	7
Organizational (ORG)	7
Finance (FIN)	5

	LC
Human Capital (HC)	7
Physical Assets (PHA)	7
Organizational (ORG)	6
Finance (FIN)	5

Table 7: Ordering of CF and Competitors' Scores

To calculate CI for each company, the scores have been ranked, with finance representing the smallest criteria for CF and the competitors. While human capital is ranked as the largest criteria for CF and TBC, human capital represents the second smallest category for LC. At this stage, it is difficult to determine which company has the highest chance to achieve sustainable competitive advantage. Further steps have to be conducted to gain deeper understanding. Furthermore, while the ordering in *Table 7* is significantly crucial to be able to achieve the following step, the interactions displayed in *Table 8* are essential to obtain the final CI calculation.

	CF
HC	3
HC+PHA	4
HC+PHA+ORG	6
HC+PHA+ORG+FIN	10

	TBC
HC	3
HC+PHA	4
HC+PHA+ORG	6
HC+PHA+ORG+FIN	10

	LC
PHA	3
PHA+ORG	4
PHA+ORG+HC	6
PHA+ORG+HC+FIN	10

Table 8: Interactions of CF and Competitors' criteria

Table 7 and *Table 8* can be combined to obtain the final scores, which will disclose the highest scoring company. Additionally, CI calculations should be focused on two fundamental prerequisites: (1) utility values are applied on a common interval scale of criteria performances; and (2) a ratio scale is used for numerical value $\mu(T)$ based on each subset (T). The following calculations are suggested for CF and its competitors:

$$\text{CF: } (8-8)*3+(8-7)*4+(7-5)*6+(5-0)*10 = \mathbf{66}$$

$$\text{TBC: } (8-7)*3+(7-7)*4+(7-5)*6+(5-0)*10 = \mathbf{65}$$

$$\text{LC: } (7-7)*3+(7-6)*4+(6-5)*6+(5-0)*10 = \mathbf{60}$$

Consequently, the first ranking by the decision maker, the ordering of the scores attributed to the four categories (*i.e.*, human capital, finance, physical assets, organization), and the interactions applied to the criteria have all contributed to the opportunity to apply CI. According to *Table 9*, CI demonstrates that CF ranks first with 66 points, closely followed by TBC with 65, and lastly 60 for LC.

Alternatives' Ranking		
#	Alternative	Score
1	CF	66
2	TBC	65
3	LC	60

Table 9: Alternatives' Ranking – CF and Competitors

According to the decision maker, improvements have to occur in order to beat the competition more significantly than just by one point. The difference between first and second place is too narrow and does not allow the company to consider itself as far more competitive. Nonetheless, the decision maker believes that by obtaining the pending January 2020 transactions, CF should drastically increase the categorization of finance. The overall score, however, does not disappoint the decision maker, especially considering that CF is a young company and has already made spectacular improvements since 2017.

The following topic offers deeper insight on the results obtained by the decision maker, as well as future recommendations.

3.3. Analysis of Results and Recommendations

According to the final outcome, CF was ranked in first position, but it does not abundantly outrank its competitors. The final score of TBC proves that the company deserves to be ranked as first competitor of CF and could offer similarly satisfying products and services to interested clients. LC might have scored last, but not by far, and shows tremendous hope for the future of its company by proposing services that have not yet been considered by rivals, in terms of theme houses and attracting groups of renters that share similar interest. For future recommendations, CF should work on its finance as this category was ranked poorly compared to the other categories of capabilities and resources. Furthermore, by doing so, CF will position itself higher than both of its competitors and could become the leader of its niche.

According to the implications of the methodology used, this study offers an innovative way of analyzing quantitative and qualitative resources and capabilities. This framework has never been conceived before and proposes an alternative that could be adopted by experts of different fields and, thereby, enhance strategic management. The combination of various frameworks (*i.e.*, RBV, VRIO, MCDA, and CI) allowed for the proposal presented in this study. However, as to the question of qualitative frameworks, RBV and VRIO have its share of limitations, which have been identified in terms of analyzes of intangible resources or hybrid criteria. Additionally, this dissertation focused on the precise analysis of qualitative and quantitative criteria, as a mean to comprehend the performances of companies in the area of co-living. To bypass these limitations, MCDA was introduced and presented the following benefits: (1) an alternative to evaluate complex decisions; (2) the avoidance of gaps amongst hybrid criteria; and (3) the direct participation of the decision maker in the decision-making process. For the calculation of the scores obtained by the decision maker, CI suggested an effortless way of coordinating qualitative and quantitative criteria. The decision maker based the scores on a 10-point scale and gave fair scores to each categorization, as none achieved the optimal score of 10 or the minimal score of 1. The final outcome gave a clearer understanding of the categorizations, which should be revised so as to upgrade scores for future performances.

For recommendations, the formulation of a quantified VRIO can be utilized by a variety of businesses to further understand the achievement of its pillar of intangible and tangible resources in hectic climates. The complexity and limitations that occur during the application of a traditional VRIO have been surpassed with the aid of the MCDA approach

and application of a fuzzy integral method (*i.e.*, CI). This methodology should be considered to understand the positioning of a company in its specific field and encourage performance improvements, so as to achieve sustained competitive advantage.

SYNOPSIS OF CHAPTER 3

This chapter aims to further understand how the combination of RBV and MCDA suggests a unique framework, which can provide quantified VRIO results and enhance the field of strategic management. The company – Coliving Factory (CF) – is introduced with a specific focus on their resources and capabilities. The decision maker identified four categorization categories to be applied on its resources and capabilities: (1) human capital; (2) finance; (3) physical assets; and (4) organization. The success of CF can be tracked on its practice to adopt different strategies than other French renting companies. They are renowned for their focus on the concept of co-living, which allows privacy without losing sight of their most essential cause – the fight against isolation. CF provides outstanding services to meets customers' needs (*i.e.*, access to electric cars, Netflix, food delivery services, availability to rent a studio when absent, etc.). Regarding tangible materials, CF invests in renovating obsolete buildings, which will be converted into co-living residences with individual and shared rooms. According to the VRIO postulates of applicability, in terms of tangibility, CF is focused on the credibility of its physical assets and is currently in the process of improving and restoring various residences, while providing lower prices in the competitive sector of real estate. The VRIO matrix and its four pillars (*i.e.*, valuable, rare, inimitable, organized) were applied to CF's most crucial resources and capabilities, and offered an attractive solution to achieve sustained competitive advantage in the categorization of finance and organization. Furthermore, for the performance analysis of CF and its two main competitors, The Babel Community (TBC) and La Casa (LC), the utilization of CI was suggested. The fundamental conditions of CI were respected: (1) utility values on a common interval scale of criteria performances; and (2) a ratio scale was applied for numerical value $\mu(T)$ on each subset (T). The decision maker gave various scores for evaluation, which could either increase or decrease on a 10-point scale, thus permitting the calculation of CI for CF and its competitors. Furthermore, the given scores were put in order, so as to achieve the following step of interactions, which led to achieve the final calculation of CI. The final calculation displayed that CF ranks in first position with 66 points, followed by TBC with 65 points and LC at 60. Nonetheless, due to the tight gap between the results, CF should work on their finances, as the category differed insufficiently in comparison to its other categories of resources and capabilities.

CONCLUSION

A. Results and Limitations

The predominant objective of this dissertation was set on the enhancement of the classical VRIO model. Specifically, the aim was to quantify the classical VRIO framework using the MCDA approach. This was carried out using information provided by a decision maker, who classified the resources and capabilities of his firm and thus rendered performance analyses possible.

To demonstrate the applicability of this improved tool, the present dissertation was divided in three major chapters. *Chapter 1* and *Chapter 2* illustrate the importance of the theoretical and methodological approach for the alteration of a quantified VRIO. Specifically, *Chapter 1* introduces the formerly used methods in the field of strategic management and continues with insightful information on the RBV and VRIO frameworks. RBV highlights the relevance of considering tangible and intangible resources important to ensure long-term performance success for a company. Consequently, the VRIO model is an aid for the RBV analysis to gain further comprehension about which resources can achieve sustained competitive advantage. However, VRIO has its limitations, as it is not a competent framework to apply in case of chaotic environments, and its four pillars do not complete guarantee success in a competitive climate. Complementarily, VRIO focuses on a qualitative analysis, which is not the most fitting solution, as intangible resources in primary or secondary data will be complicated to evaluate. *Chapter 2* contemplates the benefits of MCDA and how a strong anchored structure regarding complex decisions and understanding about multiple criteria guides toward knowledgeable decisions. MCDA represents an aid for the VRIO model; it encourages the full participation of decision makers, offers a framework that supports complicated decisions and proposes a ranking system with favored options and transparent vision regarding acceptable from unacceptable prospects. Further on, regarding one of VRIO's most complex limitations, MCDA is able to mend the gap between qualitative and quantitative analyses. The theoretical and methodological part of the dissertation was concluded with the introduction of CI and its potential to amass partial scores including criteria coalition. CI is able to provide deeper insight, explain results more thoroughly, and offer transparency to the decision makers, regarding the final outcome. *Chapter 3* focuses

on the utilization of CI to improve the VRIO framework. The merging of RBV and MCDA creates a novel framework, that should demonstrate the establishment of a quantified VRIO. CI was applied based on scores obtained by the decision maker. The scores were tested on four categories of resources and capabilities, and demonstrated on three co-living renting companies, which offer similar services and prices in diverse regions of France. The encouraged participation of the decision maker offers results that can be contemplated as not biased. Logically, the chosen company was ranked in first place by the decision maker, but could however not outrank the competition by far, as there was a mere one-point difference between first and second place. Nonetheless, the new methodology created for the purpose of this dissertation proves to be effective, can easily be applied and can also be used on smaller companies with a limitation of resources and capabilities (*i.e.* co-living companies). Regarding the chosen company, the most determinant resources and capabilities to achieve sustained competitive advantage could be identified easily. Furthermore, the analysis was followed by the categorization (*i.e.*, human capital, finance, physical assets, organization) of the most essential resources and capabilities of the company, the development of a VRIO matrix and the calculation of the scores using CI.

The creation of a quantified VRIO offers the opportunity of overcoming various limitations that may occur when using the traditional version of the model and should be considered for the evaluation of quantitative and qualitative analyses.

B. Managerial Implications and Concluding Remarks

As already pointed out, the aim of this dissertation was to quantify the VRIO framework using the MCDA approach. Specifically, by using information provided by the decision maker, resources and capabilities were scored and overall results were calculated using CI. The quantified VRIO model was further on applied to a small company that concentrates on the rising concept of co-living amongst renters, to better understand in which way the company could improve. This methodology has not formerly been created and demonstrates an innovative procedure to analyze quantitative and qualitative resources and capabilities. Nonetheless, to arrive at the final outcome, several frameworks were analyzed and combined (*i.e.*, RBV, VRIO, MCDA, CI). Even though RBV and VRIO work tightly together as frameworks, the obvious limitations that were determined by a variety of authors, in terms of constraints regarding the analyzes of intangible resources, struggle in turbulent climates

or incompetence of evaluation in relation to combined quantitative and qualitative criteria. MCDA is a useful tool for complex decisions and prefers the sharing of information amongst shareholders. As the avoidance of gaps represents a fundamental criterion of MCDA, qualitative and quantitative criteria coalition can be exanimated. Complementarily, CI was used to calculate the outcome obtained with the aid of the combined frameworks, and thus provides clearer insight on a company's areas in need of improvement.

The decision maker was required to give answers to a number of questions, with the possibility of interpreting the following categorization: human capital, finance, physical assets and organization as *Good* or *Bad*. The decision maker was then invited to disclose the two main competitors, and subjectively score them according to the same categorization. As can be observed from the final outcome, the decision maker does not rank his company way above their competitors. Most of the scores of the three co-living companies are identical or very close in scores, and no category obtained a perfect score (*i.e.*, 10-point scale). The decision maker attributed the most severely ranking to the finance category and, for future managerial improvement, this category should be revised so as to hopefully gain a leader position in the niche of co-living.

Additionally, the field of strategic management has strongly improved since its onset in the 1960s and has continuously increased and altered correspondingly to the evolution of the economy over the last few decades. The expertise of strategic management was actively shaped by a variety of business agents and influenced to modernize different operations and encourage improved performance on an economical and managerial level. Nonetheless, due to the advancement in technology and quicker access to countless information, managers have a higher chance of facing unpredictable situations that could have quicker negative consequences on businesses. This phenomenon has even stronger impact on the field of strategic management, on the grounds of today's hectic and rapid changes. Considering the quick alteration that can occur in any businesses, strategic management should embrace modern methodologies, that correspond to ongoing demands. To assure the improvement of the branch of strategic management, experts should grasp onto opportunities allowing for sustained competitive advantage and grant strategical benefits for organizations. Furthermore, in an ever-changing environment, the introduction of a quantified VRIO offers a rejuvenated way of analyzing hybrid resources and capabilities.

C. Future Research

As a recommendation for future researchers, the innovativeness of strategic management and up-to-date influences have to be considered, so as to meet pending demands by discovering responses to unanswered questions. By understanding and acknowledging opportunities that may lead to competitive advantage, novel strategies can be conceived and should, hopefully, include modern technologies and adopt current topics, related to the environment and sustainability, to boost businesses. Complementarily, the methodology used in this dissertation can be applied to countless businesses and offers prospect that could eventually be applied by any organization interested about the performances of its tangible and intangible resources in a constantly changing environment. During the discovery of RBV and VRIO, countless limitations were observed by a variety of authors over different decades. These limitations hindered the continuation of the desired analyzes of this dissertation, as quantitative and qualitative could not be evaluated as an interconnected entity. As a solution, MCDA was introduced during three processual phases: structuring, evaluation and recommendations, which were then applied during the decision process with the aid of a decision maker.

MCDA offers support to the VRIO model by reinforcing the participation of the decision maker to offer straightforward information that is crucial for the final outcome. Furthermore, problematic decisions are structured, criteria are ranked according to preferences, and importance and evaluations are given as an aid to offer distinctive final decisions. The most complex limitation to encounter lies in the analysis of quantitative and qualitative criteria, which can be solved with the application of MCDA on VRIO resources and capabilities. For the calculation of scores, CI considers the importance of elucidation of aggregation, as it encourages the comprehension of the "why" in the decision process and delivers coherent quantitative justifications. Complementarily, CI manages to calculate interconnected criteria as regard to VRIO, which recognizes criteria as a singular entity. For future research projects, CI has the capability to offer clear-cut results, transparency and believes in the importance of communication to achieve advantage, explaining the constant encouragement of the decision maker to share objective and subjective comments, so as to formulate the most adequate final results.

The modern process of creating a methodology that embraces qualitative frameworks, as well as models that have the ability to deal with hybrid criteria, led to the creation of a quantified VRIO. The aid of CI gave insight into specific numbers that were

the outcome of resources and capabilities based upon four categorizations (*i.e.*, human capital, finance, physical assets, organization). Furthermore, the calculation was done on intangible and tangible resources, which demonstrates that the various steps involved in this methodology could be applied on a vast majority of fields that have faced the complexity of evaluating quantitative and qualitative capabilities. To expand this methodology to other fields would allow experts to dig deeper into their studies and offer transparent insights on performance or the possibility of improvements for organizations.

This methodology could be pushed even further and analyze not only three but a multitude of companies, to understand the positioning of a company in its specific field, as well as where companies could improve their performances to optimistically achieve sustained competitive advantage.

REFERENCES

Abastante, F., Corrente, S., Greco, S., Ishizaka, A., & Lami, I. (2019). A new parsimonious AHP methodology: Assigning priorities to many objects by comparing pairwise few reference objects. *Expert Systems with Applications*, 127, 109-120.

Aghazadeh, H. (2015). Strategic marketing management: Achieving superior business performance through intelligent marketing strategy. *Procedia – Social and Behavioral Sciences*, 207, 125-134.

Almarri, K., & Gardiner, P. (2014). Application of resource-based view to project management research: Supporters and opponents. *Procedia – Social and Behavioral Sciences*, 119, 437-445.

Amit, R., & Schoemaker, P. (1993). Strategic assets and organizational rent. *Strategic Management Journal*, 14(1), 33-46.

Amoli, S., & Aghashahi, F. (2016). An investigation on strategic management success factors in an educational complex. *Procedia – Social and Behavioral Sciences*, 230, 447-454.

Andersén, J. (2011). Strategic resources and firm performance. *Management Decision*, 49(1), 87-98.

Anderson, J., & Narus, J. (1998). Business marketing: Understand what customers value. *Harvard Business Review*, 76, 53-67.

Angilella, S., Greco, S., & Matarazzo, B. (2010). Non-additive robust ordinal regression: A multiple criteria decision model based on the Choquet integral. *European Journal of Operational Research*, 201(1), 277-288.

Angilella, S., Greco, S., Lamantia, F., & Matarazzo, B. (2004). Assessing non-additive utility for multicriteria decision aid. *European Journal of Operational Research*, 158(3), 734-744.

Ansoff, I. (1965). *Corporate Strategy*. New York: McGraw Hill.

Augier, M., & Teece, D. (2009). Dynamic capabilities and the role of managers in business strategy and economic performance. *Organization Science*, 20(2), 410-421.

Bana e Costa, C., Lourenço, J., Oliveira, M., & Bana e Costa, J. (2014). A socio-technical approach for group decision support in public strategic planning: The Pernambuco PPA case. *Group Decision & Negotiation*, 23(1), 5-29.

Bana e Costa, C.; Stewart, T., & Vansnick, J. (1997). Multicriteria decision analysis: Some thoughts based on the tutorial and discussion sessions of the ESIGMA meetings. *European Journal of Operational Research*, 99(1), 28-37.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120.

Barney, J. (1995). Looking inside for competitive advantage. *Academy of Management Perspectives*, 9(4), 49-61.

Barney, J. (1997). *Gaining and Sustaining Competitive Advantage*. Massachusetts: Pearson Education.

Barney, J. (2001). Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view. *Journal of Management*, 27(6), 643-650.

Barney, J. (2014). *Gaining and Sustaining Competitive Advantage*. Massachusetts: Pearson Education.

Barney, J., & Mackey, A. (2016). Text and metatext in the resource-based view. *Human Resource Management Journal*, 26(4), 369-378.

Barney, J., & Wright, P. (1998). On becoming a strategic partner: The role of human resources in gaining competitive advantage, *Human Resources Management*, 37(1), 31-46.

Barney, J., Hesterly, W., & Rosemberg, M. (2007). *Administração Estratégica e Vantagem Competitiva*. São Paulo: Pearson Educación.

Barrutia, J., & Echebarria, C. (2015). Resource-based view of sustainability engagement. *Global Environmental Change*, 34, 70-82.

Belton, V., & Stewart, T. (2002). *Multiple Criteria Decision Analysis: An Integrated Approach*. Dordrecht: Kluwer Academic Publishers.

Benmoussa, K., Laaziri, M., Khoulji, S., Kerkeb, M., & El Yamami, A. (2019). AHP-based approach for evaluating ergonomic criteria. *Procedia Manufacturing*, 32, 856-863.

Berrah, L., Mauris, G., & Montmain, J. (2008). Monitoring the improvement of an overall industrial performance based on a Choquet integral aggregation. *Omega – The International Journal of Management Science*, 36(3), 340-351.

Black, J., & Boal, K. (1994). Strategic resources: Traits, configurations and paths to sustainable competitive advantage. *Strategic Management Journal*, 15(S2), 131-148.

Bottero, M., Ferretti, V., & Pomarico, S. (2014). Assessing different possibilities for the reuse of an open-pit quarry using the Choquet integral. *Journal of Multi-Criteria Decision Analysis*, 21(1/2), 25-41.

Bottero, M., Ferretti, V., Figueira, J., Greco, S., & Roy, B. (2018). On the Choquet multiple criteria preference aggregation model: Theoretical and practical insights from a real-world application. *European Journal of Operational Research*, 271(1), 120-140.

Bowman, C., & Ambrosini, V. (2000). Value creation versus value capture: Towards a coherent definition of value in strategy. *British Journal of Management*, 11(1), 1-15.

Bowman, C., & Ambrosini, V. (2007). Identifying valuable resources. *European Management Journal*, 25(4), 320-329.

Brito, V., Ferreira, F., Pérez-Gladish, B., Govindan, K., & Meidutė-Kavaliauskienė, I. (2019). Developing a green city assessment system using cognitive maps and the Choquet integral. *Journal of Cleaner Production*, 218, 486-497.

Brown, S., & Eisenhardt, K. (1995). Product development: Past research, present findings, and future directions. *Academy of Management Review*, 20(2), 343-378.

Busby, J. (2019). The co-evolution of competition and parasitism in the resource-based view: A risk model of product counterfeiting. *European Journal of Operational Research*, 276(1), 300-313.

Büyüközkan, G., Feyzioğlu, O., & Ersoy, M. (2009). Evaluation of 4PL operating models: A decision making approach based on 2-additive Choquet integral. *International Journal of Production Economics*, 121(1), 112-120.

Carayannis, E., Ferreira, J., Jalali, M., & Ferreira, F. (2018). MCDA in knowledge-based economies: Methodological developments and real world applications. *Technological Forecasting and Social Change*, 131, 1-3.

Cardeal, N., & António, N. (2012). Valuable, rare, inimitable resources and organization (VRIO) resources or valuable, rare, inimitable resources (VRI) capabilities: What leads to competitive advantage?, *African Journal of Business Management*, 6(37), 10159-10170.

Carra, S., Monica, L., & Vignali, G. (2019). Reduction of workers' hand-arm vibration exposure through optimal machine design: AHP methodology applied to a case study. *Safety Science*, 120, 706-727.

Castellini, C., Boggia, A., Cortina, C., Dal Bosco, A., Paolotti, L., Novelli, E., & Mugnai, C. (2012). A multicriteria approach for measuring the sustainability of different poultry production systems. *Journal of Cleaner Production*, 37, 192-201.

Chandler, A. (1962). *Strategy and Structure: Chapters in the History of the American Industrial Enterprise*. Massachusetts: Beard Books.

Chatterjee, S., & Wernerfelt, B. (1991). The link between resources and type of diversification: Theory and evidence. *Strategic Management Journal*, 12(1), 33-48.

Choquet, G. (1953). Theory of capacities. *The Annales de l'Institut Fourier*, 5, 131-295.

Collis, D. (1991). A resource-based analysis of global competition: The case of the bearings industry. *Strategic Management Journal*, 12(S1), 49-68.

Corrente, S., Greco, S., & Ishizaka, A. (2016). Combining analytical hierarchy process and Choquet integral within non-additive robust ordinal regression. *Omega – The International Journal of Management Science*, 61, 2-18.

D'Aveni, R. (1994). *Hyper-Competition: Managing the Dynamics of Strategic Maneuvering*. New York: Free Press.

Dasarathy, B. (2000). Elucidative fusion systems–an exposition. *Information Fusion*, 1(1), 5-15.

De Moortel, K., & Crispeels, T. (2018). International university-university technology transfer: Strategic management framework. *Technological Forecasting and Social Change*, 135, 145-155.

Dehe, B., & Bamford, D. (2015). Development, test and comparison of two multiple criteria decision analysis (MCDA) models: A case of healthcare infrastructure location. *Expert Systems with Applications*, 42(19), 6717-6727.

Demirel, T., Demirel, N., & Kahraman, C. (2010). Multi-criteria warehouse location selection using Choquet integral. *Expert Systems with Applications*, 37(5), 3943-3952.

Dierickx, I., & Cool, K. (1989). Asset stock accumulation and sustainability of competitive advantage. *Management Science*, 35(12), 1504-1511.

Domingues, A., Marques, P., Garcia, R., Freire, F., & Dias, L. (2015). Applying multi-criteria decision analysis to the life-cycle assessment of vehicles. *Journal of Cleaner Production*, 107, 749-759.

Doz, Y. (1996). The evolution of cooperation in strategic alliances: Initial conditions or learning processes? *Strategic Management Journal*, 17(S1), 55-83.

Dožić, S. (2019). Multi-criteria decision making methods: Application in the aviation industry. *Journal of Air Transport Management*, 79, 101683.

Durbach, I., & Stewart, T. (2012). Modeling uncertainty in multi-criteria decision analysis. *European Journal of Operational Research*, 223(1), 1-14.

Eisenhardt, K., & Martin, J. (2000). Dynamic capabilities: What are they? *Strategic Management Journal*, 21(10/11), 1105-1121.

El-Hanandeh, A., & El-Zein, A. (2010). The development and application of multi-criteria decision-making tool with consideration of uncertainty: The selection of a management strategy for the bio-degradable fraction in the municipal solid waste. *Bioresource Technology*, 101(2), 555-561.

Ensslin, L., Dutra, A., & Ensslin, S. (2000). MCDA: A constructivist approach to the management of human resources at a governmental agency. *International Transactions in Operational Research*, 7(1), 79-100.

Epstein, M., & Buhovac, A. R. (2014). *Making Sustainability Work: Best Practices in Managing and Measuring Corporate Social, Environmental, and Economic Impacts*. San Francisco: Berrett-Koehler Publishers.

Estêvão, R., Ferreira, F., Rosa, Á., Govindan, K., & Meidutė-Kavaliauskienė, I. (2019). A socio-technical approach to the assessment of sustainable tourism: Adding value with a comprehensive process-oriented framework. *Journal of Cleaner Production*, 236, 117487.

Fancello, G., Carta, M., & Fadda, P. (2019). Road intersections ranking for road safety improvement: Comparative analysis of multi-criteria decision making methods. *Transport Policy*, 80, 188-196.

Faria, P., Ferreira, F., Jalali, M., Bento, P., & António, N. (2018). Combining cognitive mapping and MCDA for improving quality of life in urban areas. *Cities*, 78, 116-127.

Fernando, Y., & Wah, W. (2017). The impact of eco-innovation drivers on environmental performance: Empirical results from the green technology sector in Malaysia. *Sustainable Production and Consumption*, 12, 27-43.

Ferreira, F., Ilander, G., & Ferreira, J. (2019). MCDM/A in practice: Methodological developments and real-world applications. *Management Decision*, 57(2), 295-299.

Ferreira, F., Santos, S., & Rodrigues, P. (2011). From traditional operational research to multiple criteria decision analysis: Basic ideas on an evolving field. *Problems and Perspectives in Management*, 9(3), 114-121.

Ferreira, F., Santos, S., Rodrigues, P., & Spahr, R. (2014a). Evaluating retail banking service quality and convenience with MCDA techniques: A case study at the bank branch level. *Journal of Business Economics and Management*, 15(1), 1-21.

Ferreira, F., Santos, S., Rodrigues, P., & Spahr, R. (2014b). How to create indices for bank branch financial performance measurement using MCDA techniques: An illustrative example. *Journal of Business Economics and Management*, 15(4), 708-728.

Ferreira, F., Spahr, R., Santos, S., & Rodrigues, P. (2012). A multiple criteria framework to evaluate bank branch potential attractiveness, *International Journal of Strategic Property Management*, 16(3), 254-276.

Ferreira, J., Jalali, M., & Ferreira, F. (2018). Enhancing the decision-making virtuous cycle of ethical banking practices using the Choquet integral. *Journal of Business Research*, 88, 492-497.

Finney, R., Lueg, J., & Campbell, N. (2008). Market pioneers, late movers, and the resource-based view (RBV): A conceptual model. *Journal of Business Research*, 61(9), 925-932.

Fontes, A., Rodrigues, L., & Craig, R. (2016). A theoretical model of stakeholder perceptions of a new financial reporting system. *Accounting Forum*, 40(4), 300-31.

Ford, D., & Mouzas, S. (2008). Is there any hope? The idea of strategy in business networks. *Australasian Marketing Journal*, 16(1), 64-78.

Gallardo-Vázquez, D., & Sánchez-Hernández, M. (2014). Structural analysis of the strategic orientation to environmental protection in SMEs. *BRQ Business Research Quarterly*, 17(2), 115-128.

Garrido, E., Gomez, J., Maicas, J., & Orcos, R. (2014). The institution-based view of strategy: How to measure it. *BRQ Business Research Quarterly*, 17(2), 82-101.

Godfrey, P., & Hill, C. (1995). The problem of unobservables in strategic management research. *Strategic Management Journal*, 16(7), 519-533.

Golmohammadi, D., & Mellat-Parast, M. (2012). Developing a grey-based decision-making model for supplier selection. *International Journal of Production Economics*, 137(2), 191-200.

Gomes, L., Machado, M., Costa, F., & Rangel, L. (2013). Criteria interactions in multiple criteria decision aiding: A Choquet formulation for the TODIM method. *Procedia Computer Science*, 17, 324-331.

Gonçalves, J., Ferreira, F., Ferreira, J., & Farinha, L. (2019). A multiple criteria group decision-making approach for the assessment of small and medium-sized enterprise competitiveness. *Management Decision*, 57(2), 480-500.

Grabisch, M. (1996). The application of fuzzy integrals in multicriteria decision making. *European Journal of Operational Research*, 89(3), 445-456.

Grabisch, M. (1997). K-order additive discrete fuzzy measures and their representation. *Fuzzy Sets and Systems*, 92(2), 167-189.

Grabisch, M., & Labreuche, C. (2005a). Bi-capacities I: Definition, Möbius transform and interaction. *Fuzzy Sets and Systems*, 151(2), 211-236.

Grabisch, M., & Labreuche, C. (2005b). Bi-capacities II: The Choquet integral. *Fuzzy Sets and Systems*, 151(2), 237-259.

Grabisch, M., Kojadinovic, I., & Meyer, P. (2008). A review of methods for capacity identification in Choquet integral based multi-attribute utility theory: Applications of the Kappalab R package. *European Journal of Operational Research*, 186(2), 766-785.

Grabisch, M., Labreuche, C., & Vansnick, J. (2003). On the extension of pseudo-Boolean functions for the aggregation of interacting criteria. *European Journal of Operational Research*, 148(1), 28-47.

Grant, R. (1991). The resource-based theory of competitive advantage: Implications for strategy formulation. *California Management Review*, 33(3), 114-135.

Greco, S., Matarazzo, B., & Giove, S. (2011). The Choquet integral with respect to a level dependent capacity. *Fuzzy Sets and Systems*, 175(1), 1-35.

Greening, L., & Bernow, S. (2004). Design of coordinated energy and environmental policies: Use of multi-criteria decision-making. *Energy Policy*, 32(6), 721-735.

Guerras-Martín, L., Madhok, A., & Montoro-Sánchez, Á. (2014). The evolution of strategic management research: Recent trends and current directions. *BRQ Business Research Quarterly*, 17(2), 69-76.

Guitouni, A., & Martel, J. (1998). Tentative guidelines to help choosing an appropriate MCDA method. *European Journal of Operational Research*, 109(2), 501-521.

Helfat, C., & Raubitschek, R. (2018). Dynamic and integrative capabilities for profiting from innovation in digital platform-based ecosystems. *Research Policy*, 47(8), 1391-1399.

Hitt, M., Hoskisson, R., & Kim, H. (1997). International diversification: Effects on innovation and firm performance in product-diversified firms. *Academy of Management Journal*, 40(4), 767-798.

Hitt, M., Keats, B., & DeMarie, S. (1998). Navigating in the new competitive landscape: Building strategic flexibility and competitive advantage in the 21st century. *Academy of Management Perspectives*, 12(4), 22-42.

Hoskisson, R., Wan, W., Yiu, D., & Hitt, M. (1999). Theory and research in strategic management: Swings of a pendulum. *Journal of Management*, 25(3), 417-456.

Hu, Y., & Chen, H. (2010). Choquet integral-based hierarchical networks for evaluating customer service perceptions on fast food stores. *Expert Systems with Applications*, 37(12), 7880-7887.

Hwang, C., & Yoon, K. (1981). Multiple criteria decision making. *Lecture Notes in Economics and Mathematical Systems*, 186, 58-191.

Jacobides, M., Knudsen, T., & Augier, M. (2006). Benefiting from innovation: Value creation, value appropriation and the role of industry architectures. *Research Policy*, 35(8), 1200-1221.

Keeney, R. (1996). Value-focused thinking: Identifying decision opportunities and creating alternatives. *European Journal of Operational Research*, 92(3), 537-549.

Kenworthy, T., & Verbeke, A. (2015). The future of strategic management research: Assessing the quality of theory borrowing. *European Management Journal*, 33(3), 179-190.

Ketchen, D., Boyd, B, & Bergh, D. (2008). Research methodology in strategic management: Past accomplishments and future challenges. *Organizational Research Methods*, 11(4), 643-658.

Killen, C., Jugdev, K., Drouin, N., & Petit, Y. (2012). Advancing project and portfolio management research: Applying strategic management theories. *International Journal of Project Management*, 30(5), 525-538.

Kochhar, R., & David, P. (1996). Institutional investors and firm innovation: A test of competing hypotheses. *Strategic Management Journal*, 17(1), 73-84.

Köseoglu, M., Okumus, F., Dogan, I., & Law, R. (2019). Intellectual structure of strategic management research in the hospitality management field: A co-citation analysis. *International Journal of Hospitality Management*, 78, 234-250.

Kouropalatis, Y., Giudici, A., & Acar, O. (2018). Business capabilities for industrial firms: A bibliometric analysis of research diffusion and impact within and beyond. *Industrial Marketing Management*, 83, 8-20.

Krishnan, A., Kasim, M., & Bakar, E. (2015). A short survey on the usage of Choquet integral and its associated fuzzy measure in multiple attribute analysis. *Procedia Computer Science*, 59, 427-434.

Kull, A., Mena, J., & Korschun, D. (2016). A resource-based view of stakeholder marketing. *Journal of Business Research*, 69(12), 5553-5560.

Lado, A., & Wilson, M. (1994). Human resource systems and sustained competitive advantage: A competency-based perspective. *Academy of Management Review*, 19(4), 699-727.

Lahdelma, R., Salminen, P., & Hokkanen, J. (2000). Using multicriteria methods in environmental planning and management. *Environmental Management*, 26(6), 595-605.

Lai, Y., & Ishizaka, A. (2019). The application of multi-criteria decision analysis methods into talent identification process: A social psychological perspective. *Journal of Business Research*, 109, 637-647.

Larsson, R. (1993). Case survey methodology: Quantitative analysis of patterns across case studies. *Academy of Management Journal*, 36(6), 1515-1546.

Lengnick-Hall, C., & Wolff, J. (1999). Similarities and contradictions in the core logic of three strategy research streams. *Strategic Management Journal*, 20(12), 1109-1132.

Lepak, D., Smith, K., & Taylor, M. (2007). Value creation and value capture: A multilevel perspective. *Academy of Management Review*, 32(1), 180-194.

Levitas, E., & Ndofor, H. (2006). What to do with the resource-based view: A few suggestions for what ails the RBV that supporters and opponents might accept. *Journal of Management Inquiry*, 15(2), 135-144.

Lin, C., Tsai, H., Wu, Y., & Kiang, M. (2012). A fuzzy quantitative VRIO-based framework for evaluating organizational activities. *Management Decision*, 50(8), 1396-1411.

Linkov, I., & Seager, T. (2011). Coupling multi-criteria decision analysis, life-cycle assessment, and risk assessment for emerging threats. *Environmental Science & Technology*, 12(45), 5068-5074.

Liu, Y., Foscht, T., Eisingerich, A., & Tsai, H. (2018). Strategic management of product and brand extensions: Extending corporate brands in B2B vs. B2C markets. *Industrial Marketing Management*, 71, 147-159.

Lockett, A., Thompson, S., & Morgenstern, U. (2009). The development of the resource-based view of the firm: A critical appraisal. *International Journal of Management Reviews*, 11(1), 9-28.

Lopes, J., Farinha, L., Ferreira, J., & Silveira, P. (2018). Does regional VRIO model help policy-makers to assess the resources of a region? A stakeholder perception approach. *Land Use Policy*, 79, 659-670.

Maatman, M., Bondarouk, T., & Looise, J. (2010). Conceptualising the capabilities and value creation of HRM shared service models. *Human Resource Management Review*, 20(4), 327-339.

Madhok, A., & Marques, R. (2014). Towards an action-based perspective on firm competitiveness. *BRQ Business Research Quarterly*, 17(2), 77-81.

Mahdi, O., Nassar, I., & Almsafir, M. (2019). Knowledge management processes and sustainable competitive advantage: An empirical examination in private universities. *Journal of Business Research,* 94, 320-334.

Marichal, J., & Roubens, M. (2000). Determination of weights of interacting criteria from a reference set. *European journal of operational Research*, 124(3), 641-650.

Markides, C., & Williamson, P. (1994). Related diversification, core competences and corporate performance. *Strategic Management Journal*, 15(S2), 149-165.

Marttunen, M., Lienert, J., & Belton, V. (2017). Structuring problems for multi-criteria decision analysis in practice: A literature review of method combinations. *European Journal of Operational Research*, 263(1), 1-17.

McWilliams, A., & Smart, D. (1995). The resource-based view of the firm: Does it go far enough in shedding the assumptions of the SCP paradigm? *Journal of Management Inquiry*, 4(4), 309-316.

Meehan, J., Menzies, L., & Michaelides, R. (2017). The long shadow of public policy: Barriers to a value-based approach in healthcare procurement. *Journal of Purchasing and Supply Management*, 23(4), 229-241.

Mendoza, G., & Martins, H. (2006). Multi-criteria decision analysis in natural resource management: A critical review of methods and new modelling paradigms. *Forest Ecology and Management*, 230(1/3), 1-22.

Miller, D., & Shamsie, J. (1996). The resource-based view of the firm in two environments: The Hollywood film studios from 1936 to 1965. *Academy of Management Journal*, 39(3), 519-543.

Mitra, A., O'Regan, N., & Sarpong, D. (2018). Cloud resource adaptation: A resource based perspective on value creation for corporate growth. *Technological Forecasting and Social Change*, 130, 28-38.

Moghtadernejad, S., Mirza, M., & Chouinard, L. (2019). Determination of the fuzzy measures for multicriteria and optimal design of a building façade using Choquet integrals. *Journal of Building Engineering*, 26, 100877.

Morais, D., & Almeida, A. (2006). Water supply system decision making using multicriteria analysis. *Water SA*, 32(2), 229-236.

Morente-Molinera, J., Wu, X., Morfeq, A., Al-Hmouz, R., & Herrera-Viedma, E. (2020). A novel multi-criteria group decision-making method for heterogeneous and dynamic contexts using multi-granular fuzzy linguistic modelling and consensus measures. *Information Fusion*, 53, 240-250.

Murofushi, T., & Sugeno, M. (1991). A theory of fuzzy measures: Representations, the Choquet integral, and null sets. *Journal of Mathematical Analysis and Applications*, 159(2), 532-549.

Nag, R., Hambrick, D., & Chen, M. (2007). What is strategic management, really? Inductive derivation of a consensus definition of the field. *Strategic Management Journal*, 28(9), 935-955.

Napshin, S., & Marchisio, G. (2017). The challenges of teaching strategic management: Including the Institution based view. *The International Journal of Management Education*, 15(3), 470-480.

Njoya, E., & Niemeier, H. (2011). Do dedicated low-cost passenger terminals create competitive advantages for airports?. *Research in Transportation Business & Management*, 1(1), 55-61.

Oliveira, I., Carayannis, E., Ferreira, F., Jalali, M., Carlucci, D., & Ferreira, J. (2018). Constructing home safety indices for strategic planning in residential real estate: A socio-technical approach. *Technological Forecasting and Social Change*, 131, 67-77.

Opricovic, S. (1998). *Multicriteria Optimization of Civil Engineering Systems*. Belgrade: Faculty of Civil Engineering.

Ormerod, R. (2013). Logic and rationality in OR interventions: An examination in the light of the 'critical rationalist' approach. *Journal of the Operational Research Society*, 64(4), 469-487.

Ouyang, Y., & Li, J. (2004). A note on the monotone set functions defined by Choquet integral. *Fuzzy Sets and Systems*, 146(1), 147-151.

Peteraf, M. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, 14(3), 179-191.

Porter, M. (1979). Forces affecting competitive intensity: How competitive forces shape strategy. *Harvard Business Review*, 57(2), 137-145.

Porter, M. (1980). *Competitive Strategy*. New York: Free Press.

Prasad, S. (2018). Business model for transforming a coal mining asset into a rent generating resource: A study under multiple strategic frameworks. *Resources Policy*, 55(C), 163-170.

Pricop, O. (2012). Critical aspects in the strategic management theory. *Procedia – Social and Behavioral Sciences*, 58, 98-107.

Priem, R. (2007). A consumer perspective on value creation. *Academy of Management Review*, 32(1), 219-235.

Priem, R., & Butler, J. (2001). Is the resource-based "view" a useful perspective for strategic management research? *Academy of Management Review*, 26(1), 22-40.

Progoulaki, M., & Theotokas, I. (2010). Human resource management and competitive advantage: An application of resource-based view in the shipping industry. *Marine Policy*, 34(3), 575-582.

Ralescu, D., & Adams, G. (1980). The fuzzy integral. *Journal of Mathematical Analysis and Applications*, 75(2), 562-570.

Ram, C., Montibeller, G., & Morton, A. (2011). Extending the use of scenario planning and MCDA for the evaluation of strategic options. *Journal of the Operational Research Society*, 62(5), 817-829.

Rechenthin, D. (2004). Project safety as a sustainable competitive advantage. *Journal of Safety Research*, 35(3), 297-308.

Reed, R., & Defillippi, R. J. (1990). Causal ambiguity, barriers to imitation, and sustainable competitive advantage. *Academy of Management Review*, 15(1), 88-102.

Rodrigues, M., & Mendes, L. (2018). Mapping of the literature on social responsibility in the mining industry: A systematic literature review. *Journal of Cleaner Production*, 181, 88-101.

Roy, B. (1985). *Méthodologie Multicritère d'Aide à la Décision*. Paris: Economica.

Roy, B., & Vanderpooten, D. (1996). The European school of MCDA: Emergence, basic features and current works. *Journal of Multi-Criteria Decision Analysis*, 5(1), 22-38.

Ruokonen, E., & Temmes, A. (2019). The approaches of strategic environmental management used by mining companies in Finland. *Journal of Cleaner Production*, 210, 466-476.

Saarikoski, H., Mustajoki, J., Hjerppe, T., & Aapala, K. (2019). Participatory multi-criteria decision analysis in valuing peatland ecosystem services: Trade-offs related to peat extraction vs. pristine peatlands in Southern Finland. *Ecological Economics*, 162, 17-28.

Saaty, T. (1977). A scaling method for priorities in hierarchical structures. *Journal of Mathematical Psychology*, 15(3), 234-281.

Saaty, T. (1980). *The Analytic Hierarchy Process: Planning, Priority Setting, Resource Allocation*. London: McGraw-Hill.

Saaty, T. (2008). Decision making with the analytic hierarchy process. *International Journal of Services Sciences*, 1(1), 83-98.

Sansa, M., Badreddine, A., & Romdhane, T. (2019). A new approach for sustainable design scenarios selection: A case study in a Tunisian company. *Journal of Cleaner Production*, 232, 587-607.

Santos, C., Piechnicki, F., Loures, E.., & Santos, E. (2017). Mapping the conceptual relationship among data analysis, knowledge generation and decision-making in industrial processes. *Procedia Manufacturing*, 11, 1751-1758.

Shieh, J., Wu, H., & Liu, H. (2009). Applying a complexity-based Choquet integral to evaluate students' performance. *Expert Systems with Applications*, 36(3), 5100-5106.

Shields, D., Blengini, G., & Solar, S. (2011). Integrating life cycle assessment and other tools for ex ante integrated sustainability assessment in the minerals industry. *American Journal of Applied Sciences*, 8(11), 1214.

Silva, A., Ferreira, F., Carayannis, E., & Ferreira, J. (2019). Measuring SMEs' propensity for open innovation using cognitive mapping and MCDA. *IEEE Transactions on Engineering Management*, DOI:10.1109/TEM.2019.2895276.

Sirmon, D., Hitt, M., & Ireland, R. (2007). Managing firm resources in dynamic environments to create value: Looking inside the black box. *Academy of Management Review*, 32(1), 273-292.

Sousa, M., & Rocha, Á. (2019a). Digital learning: Developing skills for digital transformation of organizations. *Future Generation Computer Systems*, 91, 327-334.

Sousa, M., & Rocha, Á. (2019b). Strategic knowledge management in the digital Age: JBR special issue editorial. *Journal of Business Research*, 94, 223-226.

Stimpert, J., &, I. (1997). Seeing the big picture: The influence of industry, diversification, and business strategy on performance. *Academy of Management Journal*, 40(3), 560-583.

Sullivan, K., Thomas, S., & Rosano, M. (2018). Using industrial ecology and strategic management concepts to pursue the sustainable development goals. *Journal of Cleaner Production*, 174, 237-246.

Tan, C., & Chen, X. (2010). Intuitionistic fuzzy Choquet integral operator for multi-criteria decision making. *Expert Systems with Applications*, 37(1), 149-157.

Teece, D. (2007). Explicating dynamic capabilities: The nature and micro-foundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28(13), 1319-1350.

Teece, D. (2018). Business models and dynamic capabilities. *Long Range Planning*, 51(1), 40-49.

Teece, D., & Pisano, G. (1994). The dynamic capabilities of firms: An introduction. *Industrial and Corporate Change*, 3(3), 537-556.

Teece, D., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533.

Tran, T., Yuen, K., Li, K., Balci, G., & Ma, F. (2020). A theory-driven identification and ranking of the critical success factors of sustainable shipping management. *Journal of Cleaner Production*, 243, 118401.

Tröster, R., & Hiete, M. (2019). Do voluntary sustainability certification schemes in the sector of mineral resources meet stakeholder demands? A multi-criteria decision analysis. *Resources Policy*, 63, 101432.

Tsai, H., & Lu, I. (2006). The evaluation of service quality using generalized Choquet integral. *Information Sciences*, 176(6), 640-663.

Tseng, M., Wu, K., Ma, L., Kuo, T., & Sai, F. (2019). A hierarchical framework for assessing corporate sustainability performance using a hybrid fuzzy synthetic method-DEMATEL. *Technological Forecasting and Social Change*, 144, 524-533.

Vergne, J., & Durand, R. (2011). The path of most persistence: An evolutionary perspective on path dependence and dynamic capabilities. *Organization Studies*, 32(3), 365-382.

Wang, R. (2011). Some inequalities and convergence theorems for Choquet integrals. *Journal of Applied Mathematics and Computing*, 35(1/2), 305-321.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171-180.

Wills-Johnson, N. (2008). The networked firm: A framework for RBV. *Journal of Management Development*, 27(2), 214-224.

Wong, D., & Ngai, E. (2019). Critical review of supply chain innovation research (1999–2016). *Industrial Marketing Management*, 82, 158-187.

Xu, B., & Ouenniche, J. (2012). Performance evaluation of competing forecasting models: A multidimensional framework based on MCDA. *Expert Systems with Applications*, 39(9), 8312-8324.

Yang, J. (2001). Rule and utility based evidential reasoning approach for multi-attribute decision analysis under uncertainties. *European Journal of Operational Research*, 131(1), 31-61.

Zanghelini, G., Cherubini, E., & Soares, S. (2018). How multi-criteria decision analysis (MCDA) is aiding life cycle assessment (LCA) in results interpretation. *Journal of Cleaner Production*, 172, 609-622.

Zeleny, M. (1982). *Multiple Criteria Decision Making*. New York: McGraw-Hill.

Zopounidis, C., & Doumpos, M. (2002). Multi-criteria decision aid in financial decision making: Methodologies and literature review. *Journal of Multi-Criteria Decision Analysis*, 11(4/5), 167-186.